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ABSTRACT

The catalog is a description of the many types of training programs and cooperative relationships that exist among Federal Laboratories and contract centers and universities. The programs are devoted to enhancing or maintaining the professional competence of staff personnel in their fields of specialization. The programs identified in the report were selected because of their geographic location, representative programs, or unusual features, and is not an inclusive list. The report includes education of laboratory employees, work-oriented activities, personnel interchange, equipment interchange, curriculum, use of television, and other audiovisual aids. Included is information regarding whom to contact for additional information. (BB)

CATALOG OF

FEDERAL LABORATORY-UNIVERSITY PROGRAMS AND RELATIONSHIPS

REPORT TO THE

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY
Committee on Federal Laboratories

August 1969

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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FEDERAL LABORATORY-UNIVERSITY PROGRAMS AND RELATIONSHIPS

REPORT TO THE

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY
Committee on Federal Laboratories

August 1969

A description of the many types of training programs and cooperative relationships that exist among Federal laboratories and contract centers and universities

EXECUTIVE OFFICE OF THE PRESIDENT
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CATALOG OF FEDERAL LABORATORY-UNIVERSITY PROGRAMS AND RELATIONSHIPS

1. INTRODUCTION

This catalog describes many of the cooperative programs that in recent years have been developed between Federal scientific laboratories and academic institutions to their mutual advantage. So varied in nature as almost to defy classification, these programs are in large part devoted to enhancing or maintaining the professional competence of staff personnel in their fields of specialization.

In general, the success of a Federal laboratory's educational ventures is keyed to its needs and local situation, involving its mission, disciplines, and proximity to nearby universities. Hence, various optional arrangements are described in an effort to identify practices that may suit a laboratory's particular requirements. Thus, it is hoped that laboratory directors will be encouraged to adapt or develop means of strengthening their own research and development capabilities.

Where particular mechanisms in this report appear relevant to needs of a laboratory, that laboratory may write to or phone the designated contact at any of the organizations indicated as references in the text. In this way, the laboratory can obtain detailed information about programs and their benefits, problems, and recommended procedures.

Almost all of the programs described in this document have evolved under existing general authority. Many of them, including several based upon specific agency legislation, are described in the report, "Education and the Federal Laboratories," issued by the Federal Council for Science and Technology in March 1968,[1] or in the proceedings of the symposium on "Education and Federal Laboratory-University Relationships," held in Washington on October 29-31, 1968 under the joint sponsorship of the Federal Council for Science and Technology and the American Council on Education.[2]

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[1] Copies of "Education and the Federal Laboratories" may be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151 for $3.00 per copy. Refer to document PB 178018.

[2] Copies of the Proceedings of the symposium on "Education and Federal Laboratory-University Relationships" may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $2.00 per copy. Catalog No. Y3.F31/16:2ED 8/2.

The laboratories identified with programs discussed in this report were selected because of their geographical location, or because their programs either are representative or include unusual features not found elsewhere. No attempt has been made to mention all laboratories involved in a particular type of program.

II. EDUCATION OF LABORATORY EMPLOYEES

A. GENERAL SUMMARY OF OBJECTIVES AND BENEFITS

Vigorous and productive Federal laboratories and government-owned contractor-operated facilities maintain their vitality, in part, by providing for the continuing education of their professional staff. The activities designed primarily to educate their own employees range from academic course work, on and off base and in and out of hours, to cooperative training arrangements involving the professional staffs of academic institutions as well as other government and non-government organizations. The principal objectives are:

1. to maintain the general competence of professional staff members by providing them with opportunities to keep up to date in their specialties and related fields;
2. to provide specific educational experience to enable the professional staff to undertake work in management and other professional fields in which they have not had previous experience;
3. to provide intensive short-term training in specific techniques where these are needed to keep pace with changing technology;
4. to improve the recruitment and retention capability of the laboratories by strengthening and improving the intellectual quality of laboratory programs and the staff and enhancing university ties;
5. to educate and train personnel in shortage fields where recruitment is either difficult or impossible; and
6. to strengthen national competence in areas of science and engineering related to laboratory missions.

B. TYPES OF PROGRAMS

1. College-level Academic Course Work – Credit and Noncredit

a. Description

This type of educational activity may involve on-base or off-base college work at the graduate or undergraduate level, and may be short-term or long-term and in-hours or out-of-hours. (See also "Area Cooperation Programs," page 8 .)

(1) On-base programs may be established to provide conveniently located graduate or undergraduate course instruction. These are

usually credit courses which enable the employee to complete the academic requirements for a bachelor or graduate degree on a part-time basis while acquiring full professional competence. Often the residency requirements for a degree are considered to be met under such programs. The educational process may be accelerated by offering courses during regular working hours as well as having them take courses on their own time. Most schedules require the employee to take at least 50% of his study work on his own time.

In these programs, all or part of the cost for tuition and books is usually paid by the laboratory. Such payments are generally subject to the attainment of acceptable course grades. Since the course work is almost always focused upon improving the employee's working competence and growth potential, it is considered directly relevant to the missions of the Federal laboratories concerned.

Some laboratories require their employees to demonstrate their personal interest and learning potential by taking the initial classwork after hours at their own expense, without direct support from the employing laboratory. In these cases, the employer may subsequently provide either full or partial financial support after the employee exhibits continuing scholastic success. This variation tends to weed out those who are insufficiently motivated or qualified.

(2) Off-base programs may involve either part-time or full-time study. They may well lead to undergraduate or graduate degrees in science or engineering.

The costs of full-time study (long-term training) are almost always paid for by the laboratory. These include the salary, tuition, fees, and books, and, if change of station is involved, per diem and travel expenses of the individual and sometimes his family expenses also.

Part-time college credit courses, often pointed toward a degree, are usually offered off-base within a local commuting area under the auspices of a local university or its local branch. On-campus, part-time course work is also provided to enable technicians and professionals to enhance their competence in their specialized fields. These are updating mechanisms which may or may not lead to a degree. Part-time course work is generally financed under conditions similar to those outlined above for on-base programs.

b. Specific Objectives and Benefits

The principal objective of course work is to enhance an employee's professional competence and growth potential by providing training that is directly related to mission goals and operational efficiency. The provision of continuing education and training is also an excellent aid to the recruitment and retention of staff. The promise of an opportunity for continued education at Government expense, usually with adjusted duty hours, helps Federal laboratories to attract and keep the better college graduates in science and engineering.

c. Authority and Methodology

(1) On-base Programs. Laboratories routinely enter into agreements with nearby colleges and universities to provide formal course work which parallels the technical orientation of the mission. The laboratories provide space, experimental facilities, teaching support, counseling, logistical support (record keeping), and other administrative services. Where there is shared responsibility for teaching, laboratory staff members generally hold adjunct teaching appointments of some sort with the university under whose auspices the program is conducted.

Various methods are available to enable university faculty to teach and to provide teaching materials and other services. These include contracts for materials and for services (where Government supervision of the work is not involved) and several kinds of appointments (used where the Government supervises the work). Appointments can provide for many different working schedules, including intermittent work.

Where a laboratory is not within reasonable commuting distance of a university, it sometimes enters into a contract with a university to establish an off-campus graduate extension program at the laboratory.[1] Such programs enable members of the laboratory staff to complete the requirements for advanced degrees in a science or engineering discipline, with thesis work supervised by either an on-campus graduate advisor or a laboratory staff member approved for thesis supervision. Responsibility for conduct of the program is usually shared jointly by the laboratory and the university. Sometimes, in the case of large programs, a university staff member, responsible for registration and administrative details, is placed in residence at the laboratory.

The use of Federal space, either after hours or on a split-time basis, is frequently accompanied by:

(a) assignment of professorial or other rank to Federal employees to permit them to serve as thesis supervisors for advanced degrees, with the research conducted in-house;

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[1] Copies of a Civil Service Commission publication, Pamphlet T-4, "Off-Campus Study Centers for Federal Employees," may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $1.25 per copy.

In Fiscal Year 1968, fourteen Federal agencies sponsored a total of 129 off-campus study centers in cooperation with 91 schools and universities. Nearly 26,000 employees participated in courses offered at the centers located in 30 states, the District of Columbia, Puerto Rico and Europe.

(b) making specialized equipment or instrumentation available to universities for graduate student research; and

(c) appointment of university staff members or graduate students on a part-time or summer employment basis.

(2) Off-base Programs. The authority provided in the Government Employees Training Act (Chapter 41 of Title 5, United States Code) is commonly used to provide short or long term training (part-time or full-time) tailored to a staff member's professional growth needs. Most difficulties involving the Government Employees Training Act arise from failure of the laboratory or agency management fully to perceive and utilize the extremely comprehensive and flexible educational provisions that are available. For example:

- The limitation of one percent of the total number of man-years of civilian employment on training in non-Government facilities during any fiscal year is levied against employment at the agency or department level, and, therefore, should not be interpreted as a constraint on the level or amount of training authorized by any particular laboratory. Further, the one percent limitation does not include training under 40 hours and it excludes so-called in-house training.

- Nor does the provision that limits training to one year in ten years of service realistically represent a problem. In training personnel for most positions in natural or mathematical science and engineering, the Civil Service Commission has changed the rule to two years for each ten years of service. An academic year does not constitute a full year of training.

- Although Government training legislation precludes authorizing training for the sole purpose of obtaining a degree, almost all agencies routinely authorize such training where the degree is a by-product of taking the course work, including the thesis or dissertation, necessary to attain full professional competence.

d. Partial List of Organizations With Extensive Programs of Academic Course Work

Organization[1]	Type of Activity
Army Ballistic Research Laboratories Aberdeen Proving Ground, Md.	Wide and diversified range of educational activities--on- and off-base, part- and full-time.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

Organization[1]	Type of Activity
Army Missile Command Redstone Arsenal, Ala. and Training Director George C. Marshall Space Flight Center, NASA Huntsville, Ala.	Multi-organization cooperation in extensive educational activities at graduate and undergraduate levels.
Training Director Electronic Research Center, NASA Cambridge, Mass.	Wide range of educational activities--part-time, full-time, off-base.
Training Director Goddard Space Flight Center, NASA Greenbelt, Md.	Wide range of educational activities--part-time, full-time, off-base.
Natick Laboratories U.S. Army Natick, Mass.	On- and off-base college study programs, short and long term.
Educational Office National Bureau of Standards Washington, D.C.	On-base graduate school and course arrangements with a number of universities.
Naval Ordnance Laboratory White Oak, Md.	Multi-educational activities, short and long term, GETA and contract, undergraduate and graduate, on- and off-campus.
Naval Weapons Center China Lake, Calif.	Federal laboratory and university cooperation in providing graduate educational programs in academically isolated environment.
Western Utilization Research & Development Division Agricultural Research Service Albany, Calif.	Long-term graduate educational activities.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

2. Area Cooperation Programs

a. Description

"Area Cooperation Programs" are joint educational programs established and conducted by several organizations in the same general geographic location. These programs may involve the pooling of manpower, space, and equipment to establish area graduate institutions, regional training centers, area workshops, and seminars, etc. This approach is particularly useful where a single organization, Federal or non-Federal, lacks the ability to "go it alone." Frequently a collaborative approach, based upon proximity, easy communication, and complementary needs, may be in the best interest of all parties regardless of individual organizational capabilities.

b. Specific Objectives and Benefits

The chief objective is to provide adequate resources essential to the development of the scientific and technical competences of interest to the cooperating organizations. Area cooperation offers an economical and effective way to combine the educational resources of individual organizations into a more comprehensive and fully utilized educational program. It provides a framework for evolving from a series of extension courses to a full-scale university operation conferring undergraduate and graduate degrees either on-base or on-campus. The degree conferring agency may be either a single graduate institution or an institution formed by consortia of universities, industries, and laboratories. This, in turn:

(1) provides an academic atmosphere and environment which attracts and retains superior scientists and engineers;

(2) helps overcome residency, minimum enrollment, and other problems that occur when laboratories do not take advantage of a multi-laboratory, university and industrial approach;

(3) satisfies the expressed desire of many scientists and engineers to teach and work in an accredited academic environment, keeping themselves attuned to new thinking and developments in changing curricula and educational emphasis; and

(4) provides a source of college graduates for future employment.

c. Authority and Methodology

Successful educational partnerships are not easily established. Those now at the point of fruition are the result of years of negotiation. Almost all of them first started as pilot efforts with limited goals. While proximity and easy communication generally ease the problems of establishing academic connections, in other circumstances the inaccessibility of local universities and the absence of technological competence have served to motivate management to work with university administrations, other area laboratories, and state and local governments to bring university extensions to the laboratory site.

(1) Informal Arrangements. Common interests can lead to spontaneous efforts to engage in collaborative work and educational activities. For example, at Flagstaff, Arizona, almost every segment of the community collaborates closely in establishing studies of mutual interest in the fields of astrogeology and astronomy. There is a sharing of equipment and interchange of personnel between Federal and non-Federal groups. Postdoctoral exchanges, guest-worker appointments, visiting lecture series, seminars, workshops, etc., form a continuing pattern of informal educational activity. For a detailed description of the various authorities available for the appointment of non-Federal personnel whenever it is necessary to formalize arrangements for personnel interaction, see Chapter V, Section B.1.c "Authority and Methodology," pages 37-41.

(2) University Consortia and Agency Graduate Schools. In other locations, educational arrangements may be more structured and formalized. Educational activities may actually be physically located at a laboratory where study programs, particularly at the graduate level, are offered off-campus by a university or consortium of universities.

An example of the foregoing involves the recently formed 70-S Graduate Educational Committee. This has resulted in a program of close cooperation between six universities and nearby industrial and Federal institutions. One aspect of this collaboration has been the establishment of a pilot on-base graduate education program at the National Bureau of Standards, with courses taught by faculty members from the participating institutions. The program is designed as a graduate program, rather than an assortment of courses, with advance agreement reached among the institutions and universities as to the courses that will be taught. Course credits up to six credit hours are transferable from one institution to another. Degrees are conferred by one of the institutions in which the employee is enrolled. Bringing the university operation to a locale with a large concentration of Federal and industrial scientists and engineers accelerates the academic process, results in dollar savings in travel time of students, and helps meet minimum enrollment requirements for courses.

(3) Multi-organization Establishment of a University. Federal grants and contracts, together with state aid, have been used to develop multi-establishment graduate or undergraduate institutions. In some cases states and the Federal Government have made land available for this purpose. Both government and universities may provide personnel, equipment, and buildings. Provisions for independent boards of trustees, administration, faculty, and accreditation may be part of a working agreement between state, city, and Federal laboratories.

(4) Interagency Training Programs. Interagency training programs administered by individual agencies or groups of agencies and coordinated by the Civil Service Commission are other examples of the pooling of personnel and equipment to provide more and better training. Interagency training bulletins which identify programs meeting specific managerial or employee needs are published annually by the CSC central and regional offices. These bulletins are updated through the issuance of monthly interagency training calendars. Such inventories are especially useful in that they codify and describe the course matter so that agencies can easily determine whether the programs satisfy their specialized needs and whether they are available in their local areas. A broad array of courses is given, ranging from the management sciences to highly specialized subjects of interest to particular occupational groups.

d. Partial List of Organizations participating in Area Cooperation Programs

Organization[1]	Type of Activity
Army Missile Command Redstone Arsenal, Ala. and Training Director George C. Marshall Space Flight Center, NASA Huntsville, Ala. and University of Alabama Huntsville, Ala.	The University of Alabama establishes a Research Institute at Huntsville to serve two agencies.
Central and Regional Offices Civil Service Commission	Interagency training programs.
Associate Director for Academic Liaison National Bureau of Standards Washington, D.C.	A joint graduate educational committee, Federal and industry laboratories and institutions, and a consortium of universities participate in a single program.
Technical Director Annapolis Division Naval Ship Research & Development Center Annapolis, Md.	Laboratory efforts to involve industrial, community, and state officials in bringing an extension of a university to a relatively isolated area.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

Organization[1]	Type of Activity
U.S. Geological Survey Flagstaff, Ariz.	An informally structured community-oriented effort to blend the work of Federal, university, and non-Federal groups.
Aeronautical Systems Division Wright-Patterson Air Force Base Dayton, Ohio and Wright State University Dayton, Ohio	Establishment of Wright State University to serve the Dayton area.

3. Technician Training (Certification Program)

a. Description

Technician training programs, leading to the award of formal certificates, generally involve a series of courses of instruction that enable non-degree-holding personnel in support positions to learn or to keep abreast of new procedures, techniques, methods, and instrumentation.

b. Specific Objectives and Benefits

The objective is both to train and to upgrade competent technicians, and to enable professionals to free themselves from activities that normally should be performed by technicians. Training directly related to a technician's specialized field increases his immediate competence and potential for career development and enables him to keep pace with new technologies.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

c. Authority and Methodology

A number of mechanisms are available to develop technician skills:

(1) Specialized programs available from technical institutes may be utilized to provide either general job orientation or special training in mathematics, physics, or other specific science-oriented fields. Training arrangements can be established either by means of a contract, or under other provisions of the Government Employees Training Act. Contracting is generally more suitable when there is a recurring need for many employees to receive the same types of training and experience.

(2) On-the-job, in-service education and training programs intermixing classroom exercises with laboratory work assignments also can be established. In many cases, the laboratories themselves are ideally equipped to develop technician training curricula, particularly in new areas, and to provide in-house teaching which is specially related to program and mission needs.

(3) Where several laboratories have similar training needs, technician training costs can be decreased while increasing training output, by combining resources to provide multi-organization training programs. Such programs are often planned and coordinated by CSC or its regional offices. (This approach is discussed more fully, under Section II.B.2, "Area Cooperation Programs," page 8.)

(4) The rapid emergence of junior colleges in all parts of the country offers many laboratories a special opportunity to contract with such colleges to provide on-the-job technician training. Teachers can come from either the laboratory staff or the college faculty. Certificates awarded may be equivalent to either one or two years of college work in a general or specialized area of science or engineering.

d. Partial List of Organizations Engaged in Training of Technicians

Organization[1]	Type of Activity
Bell Telephone Laboratories Murray Hill, N.J.	Extensive tuition refund program for subprofessionals and technicians.
School of Aviation Medicine Brooks Air Force Base San Antonio, Texas	In-house courses given by laboratory staff.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

Organization[1]	Type of Activity
Training Officer National Bureau of Standards Washington, D.C.	Has an in-house certificate program and cooperative programs with colleges offering two-year degrees.
Training Officer Wallops Station, NASA Wallops Island, Va.	Short-term basic job-oriented courses in such subjects as electronics, hydraulics, etc.

4. Seminars, Workshops, Professional Meetings, and Lectures

a. Description

Informative scientist-to-scientist communication may take many forms--symposia, attendance at professional meetings, lectures, area conferences, informal exchanges such as luncheons, etc. These meetings and discussions may be fostered by the laboratory, its organizational subunits, professional societies, universities, international organizations, or even by interested groups of individuals.

b. Specific Objectives and Benefits

Scientific meetings, workshops, and seminars are forums for (1) presenting new findings to the scientific community; (2) testing new concepts, techniques, and ideas with one's peers; and (3) providing the interchanges of experience that are so essential in developing the intellectual capacity and professional ability of any professional person. Participation in this type of activity not only enables scientists to keep up to date in their fields of work, but also constitutes an integral part of the education of young scientists.

c. Authority and Methodology

Encouraging scientist-to-scientist communication does not depend upon legal or other enabling authorizations. The principal requirement is a commitment by laboratory management, either from its own resources or otherwise, to the philosophy that such activities are essential to staff development and productivity. This implies the provision of adequate travel funds and a readiness to authorize travel to professional meetings.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

In addition to effecting temporary or intermittent appointments, contracts for the services of consultants (5 U.S.C. 3109) can be used to bring in nationally and internationally renowned experts to react with their local staffs. A laboratory can also invite a speaker to give a lecture and reimburse him by means of a simple procurement order or other contract, with the cost of travel and other incidental expenses included in the purchase price.

d. Partial List of Organizations that Vigorously Promote Scientist-to-Scientist Communication

Organization[1]	Type of Activity
Forest Products Laboratory Madison, Wisconsin	Continuing dialogue between the Federal laboratory, academe, and industry.
Goddard Space Flight Center NASA Greenbelt, Md.	Numerous seminars, lectures, and symposia in science and engineering.
Educational Office National Bureau of Standards Washington, D.C.	Numerous interagency, university, and industrial interfacings.[2] Use of purchase orders to reimburse lecturers.
Deputy Director for Science National Institutes of Health Bethesda, Md.	Lectures by visitors from outside organizations and seminars similar to those in graduate departments of universities.[2]
Northern Utilization Research and Development Division Agricultural Research Service Peoria Ill.	Federal, state, university, and industrial cooperation in disseminating information on program accomplishments.
Southern Utilization Research and Development Division Agricultural Research Service New Orleans, La.	Federal, state, university, and industrial cooperation in disseminating information on program accomplishments.
Assistant Chief Geologist U.S. Geological Survey Washington, D.C.	Continuing dialogue between university and Federal scientists in series of small meetings throughout the country to disseminate and discuss new research findings and their implications.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

[2] See Appendix B for example of meeting calendar.

III. EDUCATION OF OTHERS

A. GENERAL SUMMARY OF OBJECTIVES AND BENEFITS

Many educational activities have, at least in part, the important long-range objective of advancing the state of the art in their respective fields of science and engineering. In working toward this objective, Federal laboratories and research contract centers, such as the Atomic Energy Commission's national and multipurpose laboratories, frequently not only further their ability to accomplish their own immediate mission, but also contribute to the training and education of others. In this context, laboratory educational facilities can be viewed broadly as national resources accessible in varying degrees to high school and college students and faculty members, as well as to other qualified persons throughout the country.

The education of persons who are not laboratory employees is frequently interwoven with the education of laboratory staff. Programs that blend laboratory and university educational activities are discussed in other sections of this report concerned with joint work activities, graduate education and thesis research, equipment sharing, seminars, workshops, etc. Programs oriented towards providing education and training to others, either as a specific function of the mission or for the more general welfare of the Nation, are discussed in the present section of this report.

Laboratory programs which contribute to the education of others are designed, at least in part, to:

1. stimulate the interest of youth in science careers;
2. provide useful on-the-job and other experience that improves the image of the Federal laboratory as an employer of high-caliber personnel;
3. revitalize high school curricula and enhance high school teaching competence;
4. advance the state of the art by providing specialized training in new and emerging fields of science and technology; and
5. fulfill the Government's obligation to provide training opportunities for those who are disadvantaged because of social, economic, or other reasons.

B. TYPES OF PROGRAMS[1]

1. Community Oriented Activities

a. Description

Some laboratory activities are of interest to the general public and involve elements of the local community. These programs make the Federal laboratory facilities, equipment and interdisciplinary staff skills available to high school and college students, faculty members and others who will benefit from the tieing of teaching and learning to job practice and orientation.

Community-oriented programs involving high school and junior college counselors, industrial training organizations, and the like, are effective means of familiarizing others with the course work pertinent to technician positions. Many laboratories offer summer jobs to teachers, counselors, and students in order to stimulate greater interest in technical employment.

Many Federal laboratories keep the general public informed about their programs and accomplishments through group tours, open houses, and the reception of casual visitors. Visitors' observations are supplemented by information booklets, exhibits, and lectures by staff members. Presentations over local radio and television stations, and articles in newspapers and popular magazines, also are common.

b. Specific Objectives and Benefits

Community information and training programs generate a better understanding and appreciation of the work of Federal laboratories. They should stimulate student participation and community interest in the work of Federal laboratories, and thus contribute at least indirectly to the fulfillment of future manpower needs in areas of laboratory interest.

c. Authority and Methodology

Various special and general authorities are available to establish educational programs involving high school students and teachers. Agency or laboratory personnel officers and regional Civil Service Commission offices can advise about authorities that may be used. Following are a few examples of activities currently underway.

(1) Through the use of Manpower Development and Training Act funds, 250 disadvantaged people from the Washington inner city are receiving job training at Federal laboratories. Several laboratories are

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[1] For a specific description of cooperative educational activities carried out at one federally related laboratory see Appendix C, "Higher Education Procedures and Programs at the Smithsonian Institution."

participating in this one-year program, called "Project 250," and sponsored by the Civil Service Commission. Participants are trained for 13 weeks before actual employment in such positions as laboratory aide and computer aide. The program involves the redesign and simplification of jobs and a special "Worker-Trainee" examination in order to provide employment opportunities for unskilled personnel.

(2) Under the coordination of the Oak Ridge Associated Universities (ORAU), a training and technology program is operated for unemployed and under-employed workers in six advanced occupational skills, including welding, glassblowing, and electronics. The training takes place at AEC's Y-12 Plant in Oak Ridge, Tennessee, and is supported by the Department of Labor and the Office of Education.

(3) High school students are accepted for summer work or research experience by numerous Federal laboratories. In some instances, local universities and scientific societies act as intermediaries in selecting gifted students and placing them at appropriate laboratories. In others, the laboratories deal directly with high schools, without use of an intermediary. For example:

- The National Bureau of Standards regularly offers summer jobs to National Science Fair winners, who presumably are ready for college and are definitely settled on careers in science. (Appointments excepted from the Civil Service regulations under Schedule A, Section 213.3102(Y), are authorized for finalists in national science contests.)

- An unusual activity that involves training young people in Federal research laboratories is conducted in the Washington (D.C.) area under the name, "Research Participation Program for Senior High School Students." Initiated in 1960 by local science groups as a contribution to the encouragement of science talent, it has been sponsored in recent years by the Chemistry Department of American University. Under this program, talented high school science students, nominated by their teachers and selected by the University, are placed in area research laboratories--both Federal and non-Federal--for a two-month period from mid-June to mid-August, serving as assistants to research scientists in a variety of disciplines. Each student receives a stipend of $30 per season for transportation and lunches; an additional amount may be provided in hardship cases. The students are considered to be guest workers at the host institutions.

During the 1969 season--the tenth year of the program--112 students participated and were placed in such institutions as the Walter Reed Army Institute of Research, National Institutes of Health, Geological Survey, National Bureau of Standards, Department of Agriculture, Smithsonian Institution, Naval Ordnance Laboratory, Goddard Space Flight Center, Naval Medical Research Institute, and Environmental Science Services Administration. Funds for the 1969 season, amounting to about

$12,000, were provided largely by the National Science Foundation. Contributions were made also by local science societies.

A study of this program conducted in 1964 showed that 95 percent of the students involved had continued on in science careers. This contrasts with a national average of 50 percent for high school science students in general.

(4) Curriculum assistance: The NASA Electronic Research Center at Cambridge, Massachusetts, has worked with local high schools to set up courses designed for the training of potential technicians. The Annapolis Division of the Naval Ship Research and Development Center is working to revitalize the entire curriculum at local high schools, with equal attention to academic studies and vocational training. The Training Institute of the Environmental Control Administration at Cincinnati, Ohio, has worked closely with three local high schools to develop programs of laboratory experiments and prepare closed circuit television demonstrations.

(5) Under federally financed manpower training programs many Federal laboratories provide worksite and training experiences for participants enrolled in programs such as Neighborhood Youth Corps, Job Corps, New Careers, Work Incentive Programs, etc. These youths are not employees of the Federal Government. However, these assignments may lead to permanent appointments in the Federal service through the competitive examination procedures.

There are also two special programs under which agencies are authorized under Schedule A of the Civil Service regulations to appoint young people for temporary summer employment or part-time or intermittent employment:

- Under Section 213.3102(v), summer trainees may be given temporary appointments in furtherance of the President's Youth Opportunity Program;

- Under Section 213.3102(w), high school and college students may be given part-time or intermittent employment in furtherance of the President's Youth Opportunity Stay-in-School Campaign.

(6) Laboratories may sponsor "career day" and "engineer-for-a-day" programs, wherein selected students are given vocational counsel, or are paired off with laboratory scientists for a day to observe their methods of operation.

(7) Attention is also being given to upgrading the competence of high school teachers. Teachers are brought into some laboratories either for attendance at seminars or for part-time employment. Special excepted appointment authority to permit the temporary or intermittent employment of high school science teachers is available under Section 213.3102(q) of Schedule A of the Civil Service regulations.

d. Partial List of Organizations Engaged in Programs of This Type

Organization[1]	Type of Activity
Chairman, Chemistry Department American University Washington, D.C. and Training Officer National Bureau of Standards Washington, D.C.	Placement of talented high school students as summer guest workers in Federal laboratories.
Electronic Research Center NASA Cambridge, Mass.	Assistance to local high schools on courses for technician training.
Environmental Control Administration, HEW Cincinnati, Ohio	Uses closed-circuit TV demonstrations. Scientific experiments & procedures.
Technical Director Annapolis Division Naval Ship Research and Development Center Annapolis, Md.	"Careers" and "engineer-for-a-day" programs: high school interaction including occasional teaching assistance.
Training and Technology Project Oak Ridge Associated Universities Oak Ridge, Tenn.	Includes classroom and shop work. Trainees are certified at three recognized trade and industrial levels--technical, vocational, and skilled.
Office of Public Affairs NASA Washington, D.C	Classroom material and demonstrations. Spacemobile equipped with models and lecturers for class demonstrations.
Youth & Economic Opportunity Programs Civil Service Commission Washington, D.C.	Special employment and training programs for disadvantaged youth.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

2. Teaching and Lecturing

a. Description

Advances in science and technology often require extensive reorientation of existing training programs and training procedures. At times, universities, state and local governments, industry, and foreign governments look to a Federal laboratory for assistance in providing information about the latest tools and means of dealing with increasingly complex tasks and procedures.

Many laboratory scientists and engineers are qualified to teach and lecture and benefit from the intellectual discipline and stimulation this involves. In many Federal laboratories, members of the scientific staff hold concurrent teaching appointments. Frequently these staff members teach and lecture at the laboratory, where the facilities and space are used to educate both laboratory employees and others. Workshops, seminars, short-term refresher courses, etc. are important by-products of teaching and lecturing activities.

b. Specific Objectives and Benefits

Teaching and lecturing activities are of significant value in communicating recent research results and new developments to other personnel. Such activities effectively utilize some of the valuable human resources and competence of Federal laboratories to help meet national educational needs, particularly in areas where such needs are frequently the greatest. Those trained provide a reservoir of well-qualified scientific manpower in subjects of interest to laboratory programs. There is a reverse benefit in that the teaching and association with the students frequently stimulate and improve the general competence and performance of the teacher.

c. Authority and Methodology

Many Federal laboratories are engaged in the technical training of persons who are not laboratory employees. NASA, NSF, and AEC are authorized by their legislative charters to foster educational activities as a direct contribution to their overall long-range missions. Other agencies--notably the Army Human Engineering Laboratories, the Walter Reed Army Institute of Research, the Training Institute of the Environmental Control Administration, the Federal Water Pollution Control Administration Laboratories, the Geological Survey, the National Institutes of Health, the National Bureau of Standards, and the Smithsonian Institution--have a direct responsibility for educational activities in their fields of scientific and technological interest.

Federal laboratories and research contract centers frequently sponsor lecture series, symposia series, and short-term technical courses for the benefit of regular employees, temporary summer employees, and various other groups. Some laboratories set up advisory committees representative of industry, universities and other Federal agencies to help in developing the courses and other activities. The programs are varied in technical content according to the background of the participants. These may include people from universities, industry, state government groups, and other Federal laboratories, as well as from foreign countries.

The Training Institute of the Environmental Control Administration in Cincinnati has extensive agreements with the World Health Organizations to bring foreign nationals to the Institute for training purposes. Expenses are paid by the National Science Foundation or the Agency for International Development. Frequently, the students contribute to a beneficial interaction with staff members at the Institute. WAE type appointments are used to provide for a continuing influx of students.

The same Institute presents short-term courses with laboratory work and field exercises that have been developed in response to needs expressed by state governments and other groups. Some 2500 to 3000 people have been trained each year, of whom 70 percent come from state governments and the remainder from industry, universities and other sources. The faculty for these courses is composed chiefly of Training Institute personnel. Each sponsoring agency pays its students' travel and per diem expenses.

The Bureau of Reclamation at Denver gives practical short courses in such subjects as soil mechanics, irrigation, and electricity, for the benefit of employees of other agencies as well as its own people.

The Geological Survey gives extensive field training to upwards of a hundred foreign students each year, under the sponsorship of AID, UN, and other organizations. The training involves lectures, laboratory exercises, research work, familiarization tours, and field trips. This activity is not all unilateral, since the students often contribute useful ideas to the Survey.

Through Friday and Saturday workshops the Argonne National Laboratory offers faculty members instruction and practical experience with advanced analytical instrumentation not available on their own campuses. Once a faculty member becomes familiar with the equipment, he may participate in the Faculty-Student Program by bringing his students to conduct special experiments which supplements their regular course work.

On a special released time arrangement between Oak Ridge National Laboratory and the University of Tennessee, senior scientific staff members serve as part-time professors on the University staff under a Ford Foundation grant that pays for the released time to strengthen graduate programs in science and engineering. Analogous arrangements exist between Kitt Peak National Observatory and the University of Arizona and between the National Center for Atmospheric Research and the University of Colorado.

The Walter Reed Army Institute of Research conducts training courses and workshops on medical subjects for persons from all over the world as well as for DOD employees. At least half the teaching staff is composed of WRAIR employees.

The authority for some of these programs comes from the sponsor's legislative charter to provide support for mission-oriented training to others. Other programs are sponsored simply because they have relevance to the laboratory's overall mission.

Out-of-hours teaching by Federal employees generally can be administratively approved by the laboratories as long as it does not involve the use of restricted information involved in the employees' work. Teaching during official working hours can be authorized when such teaching is administratively determined to contribute to a laboratory's capability to carry out its mission. In general, when such teaching is performed to train laboratory employees, there is no legal or regulatory inhibition against the attendance of non-Federal personnel when deemed appropriate by the laboratory, and when costs are not thereby increased.

Workshops and regular symposia are well established activities at most Federal laboratories. No special authority is needed for these since the activities are considered to contribute to accomplishment of the mission.

d. Partial List of Organizations Having Staff Engaged in Teaching

Organization[1]	Type of Activity
Public Affairs Office Ames Research Center, NASA Moffett Field, Calif.	Conferences and symposia involving universities, industry, and others.
Center for Educational Affairs Argonne National Laboratory Argonne, Ill.	Continuing activity for the benefit of college and university faculty.
Training Institute Environmental Control Administration, HEW Cincinnati, Ohio	Extensive program of training and refresher courses for university, industrial, and state health personnel.
U.S. Geological Survey Denver, Colo.	Extensive array of refresher courses and field exercises. Training of foreign geologists and hydrologists.
Human Engineering Laboratory Aberdeen Proving Ground, Md.	Technical courses for other DOD and non-DOD personnel.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

Organization[1]	Type of Activity
Foundation for Advanced Education in the Sciences c/o NIH, Bethesda, Md. and Deputy Director for Science National Institutes of Health Bethesda, Md.	Graduate program administered by Foundation for Advanced Education in the Sciences.
Public Affairs Office Lewis Research Center, NASA Cleveland, Ohio	Conferences and symposia involving universities, industry, and others.
Educational Office National Bureau of Standards Washington, D.C.	All forms of activities, placing special emphasis on the use of the Bureau staff and facilities as a national resource in mission related areas.
Oak Ridge National Laboratory Oak Ridge, Tenn.	The Education and University Relations Office provides university with teaching strengths in new fields and needed areas of improvement. In the Graduate School of Biomedical Sciences, students work in a 4-year Ph.D. program in close association with senior staff members and full-time university personnel located in Oak Ridge in the professional research environment of the National Laboratory.

3. Cooperative Work-Study Programs

a. Description

Cooperative work-study programs feature tours of on-the-job experience during periodic breaks in the academic school year. Many Federal laboratories and research contract centers have excellent cooperative work-study programs based on agreements between the laboratories and participating universities.

b. Specific Objectives and Benefits

Cooperative work-study programs strengthen university-laboratory relationships and ties by promoting the interchange of personnel, the sharing of responsibility for thesis research, and occasionally laying the foundation for joint research activities. The objective is to create a reservoir of promising young professionals for future career service in the laboratory, while also assuring the laboratory of a continuing source of technical talent during the student's undergraduate employment. In turn, work-study programs provide students with firsthand opportunities to see the application of their training to real world problems and to test their aptitudes and interests in actual application prior to completion of their education.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

c. Authority and Methodology

There are numerous work-study programs based upon agreements between laboratories and participating universities and featuring alternating tours of on-the-job training and classroom exercises. In some programs the student is recruited and appointed under Schedule B, Section 213.3202(a) of the Civil Service regulations during or prior to his freshman year of college, and he receives three months or more of on-the-job experience during regularly scheduled breaks in each academic year. The student is promoted to progressively higher duties as he advances in his academic work. After graduation he is eligible for continuing employment under career or career-conditional appointment. Other work-study programs involve longer term work assignments, typically up to six months, followed by six months of classroom work. Only a relatively few colleges participate in such programs.

A few laboratories are now entering into cooperative agreements at the graduate level. It seems clear that this arrangement will become increasingly necessary if Federal laboratories are to compete effectively for the bright science students who are continuing their education beyond the baccalaureate level without an intervening break.

Where the foregoing types of program have been successful, the sponsoring laboratory generally (1) has provided for unusually challenging work assignments during the student's undergraduate employment, (2) has paid part of the student's tuition and other costs, and (3) has concentrated the recruiting efforts on students whose home ties are close to the laboratory site.

d. Partial List of Organizations With Active Cooperative Work-Study Programs

Organization[1]	Type of Activity
NASA Training Directors:	
Flight Research Center Edwards, Calif.	Undergraduate co-op programs with nearby universities.
Langley Research Center Hampton, Va.	Undergraduate co-op programs with nearby universities.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

Organization[1]	Type of Activity
Training Director Lewis Research Center, NASA Cleveland, Ohio	Undergraduate co-op programs with nearby universities.
Naval Ordnance Laboratory White Oak, Md.	Undergraduate and graduate work-study programs involving several universities.
Training Branch Annapolis Division Naval Ship Research and Development Center Annapolis, Md.	Undergraduate work-study programs for physical science students that provide a continuous influx of well-trained employees to work as technicians until they attain full professional competence.
Personnel Department Navy Air Engineering Center Philadelphia, Pa.	Undergraduate cooperative program involving four schools; features partial tuition reimbursement.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

IV. WORK-ORIENTED ACTIVITIES

A. GENERAL SUMMARY OF OBJECTIVES AND BENEFITS

Among the most productive and lasting laboratory-university relationships are those based on cooperation in work-related activities. This is particularly true where a heavily research-oriented Federal laboratory is located close to one or more academic institutions which share interest in similar fields of science or technology.

Cooperative work-oriented activities tend to foster an informal academic atmosphere in the laboratory. They lead to a better mutual understanding of academic and Federal R&D activities and problems and enable a laboratory to enlist the talents of university scientists who often possess skills not normally possessed by the regular professional staff of the laboratory. The free interchange of ideas, the testing of new approaches on colleagues, consultation with peers on research problems, and the general discussions between professionals from the laboratory and universities, stimulate both the laboratory and university participants and open new intellectual vistas.

In such an atmosphere, thesis research by graduate students is much more likely to be conducted and to stimulate and accomplish the regular work of the laboratory. Equipment and other facilities are often freely shared on reciprocal bases, the quality of research is likely to be improved, and there is an available pool of experts to deliver lectures and participate in seminars at the laboratory.

An important by-product of these activities is an increased awareness on the part of professors of current scientific and engineering problems and the resultant emergence of better prepared graduate scientists, many of whom have become involved and interested in the work of the laboratory and constitute an excellent source of recruits for full-time regular employment.

Laboratories that enjoy close scientific and technical cooperation with universities generally encounter little or no difficulty in eliciting university cooperation to meet their educational needs.

B. TYPES OF PROGRAMS

With the demands imposed by changing technology and the ensuing shifts in emphasis and importance of national research and development goals, laboratory management and university administration have been unusually adept at developing a series of conventional and unconventional collaborative ventures to meet new developments in various fields of science and engineering.

1. Joint Research Contracts with Universities and Industry

a. Description

Many laboratories strengthen their technical contacts with the scientific community through coordinated work activities. Consultation and individual association with colleagues on scientific and technological problems is the key to these effective relationships. Joint research activities may be formal as in the case of the Joint Institute for Laboratory Astrophysics, informal as characterized by the Geological Survey activities, or both, as engaged in by the Agricultural Research Service. A commonly used approach is the negotiation of contracts that expressly provide for collaboration between Federal and other scientists in carrying out cooperative research projects.

b. Specific Objectives and Benefits

One objective of such contracts is to accomplish specific laboratory projects more quickly and effectively. Another objective is to encourage interaction with scientists in other working environments for the purpose of exchanging new knowledge, obtaining different viewpoints, and learning about new techniques that will strengthen both the research capability of the laboratory and the teaching capability of its university counterpart. Joint research endeavors, bringing Federal and university staff members together to collaborate on problems, provide the catalyst for a continuing exchange of ideas in areas of common interest.

Joint work activities also make it possible for a university to provide up-to-date and strong research programs for its students and teachers, and permit the sharing of equipment and other facilities.

c. Authority and Methodology

Many laboratory-university exchanges arise from a common interest in a particular field of science or technology and are initiated without enabling agreements or appointments. The type of arrangement discussed here is more formalized and depends upon contracts or memoranda of understanding. Some agencies have special contracting authority; all have at least limited authority to enter into mission-related contracts. Contracts may be with a university or a group of universities, with one or several departments within a university, or with one or more professors. Services of graduate students may be included. The versatility of the contract mechanism is illustrated by the following examples.

(1) The Aerospace Medical Research Laboratory at Wright-Patterson Air Force Base has established a highly specialized cardiopulmonary laboratory under contract with a university. The staffs of both institutions use the facility and the pooled effort of both parties attract scientists from all over the world, partly because of the superior facilities but more importantly because of the high quality of the research contributions.

(2) Several laboratories have contracts with a university or a consortium to establish special institutes for carrying out cooperative research ventures. NASA's Langley Research Center, for example, participated with the State of Virginia in establishing the Virginia Associated Research Center where academicians work with Federal scientists and engineers using the exceptional and costly specialized equipment and facilities at the Center. The University of California is the operating contractor for the Lawrence Radiation Laboratory with facilities at Berkeley, Livermore, and Davis, California. The Argonne Universities Association, a consortium of 30 universities, provides guidance and direction, under a contract arrangement, to the operation of Argonne National Laboratory. Brookhaven National Laboratory and the National Radio Astronomy Observatory are operated by Associated Universities Incorporated, a consortium of nine universities. The new National Accelerator Laboratory at Weston, Illinois, will be operated by the Universities Research Association Incorporated, a grouping of 50 universities from across the country. The National Center for Atmospheric Research is operated by a similar consortium, as is the Kitt Peak National Observatory and the Cerro Tololo Inter-American Observatory in Chile.

(3) The Annapolis Division of the Naval Ship Research and Development Center has developed a university coupling program by placing contracts with selected universities interested in enhancing their teaching and competence in oceanic research.

d. Partial List of Organizations With Extensive Contracts or Joint Research Activities

Organization[1]	Type of Activity
Office of the Administrator Agricultural Research Service U.S. Department of Agriculture Washington, D.C.	Collaboration with state experiment stations and their associated universities, and with other universities through contracts, grants, cooperative agreements, and memoranda of understanding.
Brookhaven National Laboratories Upton, N.Y.	Sharing of equipment and pooling of manpower to strengthen both university and laboratory potential for research, teaching, and thesis research.
Joint Institute for Laboratory Astrophysics Boulder, Colo.	University and laboratory personnel are indistinguishable on project work and teaching. Support facilities are shared.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

Organization[1]	Type of Activity
Training Director Langley Research Center, NASA Hampton, Va.	Cyclotron and laboratory space at VARC shared equally with university experimenters.
Naval Research Laboratory Washington, D.C.	Memoranda of understanding with University of Maryland (1966 and 1968); Cornell University (1966); and Catholic University of America (1967).
Smithsonian Institution Washington, D.C.	Continuing formal work interactions with academe.
Assistant Chief Geologist U.S. Geological Survey Washington, D.C.	Extensive informal arrangements and consultation between Federal scientists and university colleagues, usually without formal contracts.

2. Summer Student and Faculty Appointments

a. Description

University students and faculty members are appointed during the summer to give them firsthand work experience in an R&D environment through selection of a project, planning and conducting a study, and writing a report. Professors are given temporary summer appointments to help accomplish regular on-going professional work and to bring fresh approaches to the activities of the laboratory. In some cases their talents may represent disciplines not normally employed in quantity in the laboratory. In the case of undergraduates, the students work as aides to professional laboratory personnel.

Summer student appointments are similar in several respects to cooperative work-study arrangements as described on pages 23-25. The principal difference lies in the flexibility of summer appointment programs versus the continuing arrangements and work requirements that characterize the more formal work-study programs.

b. Specific Objectives and Benefits

Summer appointments help give the university participants a firsthand understanding of Federal scientific activities and strengthen the ties between the laboratory and universities. The engagement of university talent for short-term employment helps to fill gaps during the normally heavy summer vacation periods. Also, the university participants' interest in and knowledge of the laboratory can be of considerable help to the laboratory in its subsequent recruitment of professional staff.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

c. Authority and Methodology

Temporary and intermittent appointments at Federal laboratories may be made through regular Civil Service Commission registers, through special registers established for summer employment, and through special Schedule A authorities which permit the employment of students or faculty members without regard to the usual competitive procedures. Equivalent type appointments are also available at most AEC contract laboratories. Summer fellowships, sponsored by cooperating universities, are another mechanism which can be used. The various appointment authorities available are discussed in Chapter V under "Personnel Interchange."

Many laboratories offer continuing employment to undergraduates during a series of summer periods, without interruption of the normal educational process. Sometimes the arrangement involves an outside group or university. For example, through cooperation with the National Association of Geology Teachers, the U.S. Geological Survey employs top-ranking students in its summer geology field camps. In this case, students are selected by the Association.

d. Partial List of Organizations Having Summer Appointment Programs

Organization[1]	Type of Activity
Chairman, Chemistry Department American University Washington, D.C.	Placement of talented high school students as summer guest workers in Federal laboratories.
Center for Educational Affairs Argonne National Laboratory Argonne, Ill.	Summer Engineering Practice School, Graduate engineering students work in small groups on practical engineering problems of interest to the Laboratory. Academic credit is available.
Director, Division of Nuclear Education & Training Atomic Energy Commission Washington, D.C.	Faculty and student research participation appointments in nuclear science and engineering areas at multiple laboratories.
Kitt Peak National Observatory Tucson, Ariz.	Summer employment of graduate students in science.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

Organization[1]	Type of Activity
Regional Training Centers Civil Service Commission	The CSC regional centers are a good source of information on summer appointment programs.
Personnel Director Electronic Research Center, NASA Cambridge, Mass.	Faculty and students hired for the summer under temporary appointments.
Manned Spacecraft Center, NASA Houston, Texas	Faculty and students hired for the summer under temporary appointments.
Chief, Personnel Staffing Branch National Institutes of Health Bethesda, Md.	Summer employment emphasis on graduate students in science and disadvantaged youth.
Special Projects Office Oak Ridge Associated Universities Oak Ridge, Tenn.	Engineering Practice School in ten-week sessions during the academic year.
Director Sustaining University Program Office of University Affairs NASA Washington, D.C.	Summer faculty fellowship program in research and engineering systems design conducted in cooperation with American Society for Engineering Education, several universities, and NASA Research Centers.
Office of the Chief Geologist U.S. Geological Survey Washington, D.C.	Extensive use of WAE type appointments in general, including employment of top-ranking students in summer geology field camps in cooperation with Nat'l Assoc. of Geology Teachers.

3. Thesis Research at the Laboratory

a. Description

Many laboratory environments, with their unexcelled experimental facilities and high-caliber scientific and engineering talent, are ideally equipped to bolster the research capability of university departments. Although some universities discourage absentee research by their

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

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graduate students, where the intellectual life of the laboratories is comparable to the highest standards of universities, there is an appreciation on the part of many universities of the potential for laboratory-university relationships, and the universities work with the laboratories to develop challenging subjects for thesis research. In some areas of science, such as nuclear energy, chemical oceanography, plasma physics, metallurgy, hydrology, pharmacology, toxicology, geology, and astrogeology, the excellence of Federal laboratory programs is unrivaled.

b. Specific Objectives and Benefits

Thesis research in the laboratory:

- augments the Nation's basic resources available for graduate education;
- helps accomplish work in which the laboratory is interested;
- stimulates the regular professional staff;
- increases academic awareness of the activities and problems of the Federal R&D effort;
- strengthens university ties; and
- aids in subsequent recruitment of students for full-time professional positions.

c. Authority and Methodology

While some universities and professors who serve as thesis advisors prefer to have thesis research supervised by faculty staff at all stages, there are many instances where members of laboratory staffs also serve as part-time professors and thesis advisors. Laboratory staff members participate as codirectors of thesis studies, sit on oral examinations for graduate degrees, and serve as joint authors of student papers. These arrangements are made possible by the universities' recognition of Federal employees as adjunct professors or some equivalent designation whereby they can serve as thesis advisors for work done inhouse.

Formalized arrangements whereby university teachers and students can use Federal space and equipment for their thesis work are described in Chapter V, "Personnel Interchange."

d. Partial List of Organizations Having In-House Thesis Research

Organization[1]	Type of Activity
Director, Division of Nuclear Education & Training Atomic Energy Commission Washington, D.C.	Laboratory graduate fellowships for thesis research at AEC laboratory or contractor facility.
Naval Ordnance Laboratory White Oak, Md.	Extensive programs for training graduate students.
U.S. Geological Survey Menlo Park, Calif.	Close academic ties with laboratory staff serving on thesis committees.
Aeronautical Systems Division Wright-Patterson Air Force Base Dayton, Ohio and Wright State University Dayton, Ohio	Joint cooperation covering all requirements for thesis research.

4. Location of Laboratory on Campus

a. Description

Location of a laboratory on or adjacent to a university campus greatly facilitates the arrangement of joint work activities and other educational collaboration. When the laboratory is convenient to the campus, maximum cooperation between members of the university and laboratory staff is greatly facilitated. In some situations, cooperation is so complete that students are either unable to distinguish between laboratory staff members and those from the university, or indicate no preference in selecting courses and preceptors for graduate and postdoctoral study and in choosing research advisors for their thesis work.

At several laboratories, especially the national contract institutions, equipment and other resources are shared, and senior staff members serve as codirectors with equal status as far as the students are concerned. In at least one Federal laboratory, the NBS Joint Institute for Laboratory Astrophysics, the link with the university is a full partnership in every respect, including shared equipment, clerical and technical support personnel, teaching, research, voting rights, and administration, e.g., rotating chairmanships.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

b. Specific Objectives and Benefits

Laboratories located conveniently to campuses generally have access to more and richer benefits in all areas of education, including effective university relationships, teaching, thesis research and seminars, and to the additional expertise of the university staff. In addition to its enhancement of laboratory capabilities, this also aids in the recruitment and retention of first-rate staff.

c. Authority and Methodology

For some laboratories location and cooperative efforts are keyed to filling voids in technical competence by augmenting the resources available to the cooperating institutions. The Tropical Atlantic Biological Laboratory of the Bureau of Commercial Fisheries in Florida, for example, supports education and research of university students, teachers, and visiting scientists by making its laboratory space, facilities, research vessels, and extensive collection of fish freely available for study and research purposes.

The hundreds of small agricultural research staffs located at land-grant colleges throughout the country are examples of an old and particularly successful research relationship in which the cooperating institutions not only agree on the job to be done, but work together in making contributions to the advancement of agriculture. There is no dominant mode of operations. The number of Federal staff members may be small--even one man--or large; and the Federal unit may be located on campus in state or Federal owned buildings, or away from the campus but as part of the university.

d. Partial List of Organizations Located on or Adjacent to University Campuses

Organization[1]	Type of Activity
Agricultural Research Service USDA, land-grant colleges (nationwide)	Varied patterns of collaboration involving education and research. Problem oriented.
Ames Laboratory, AEC Iowa State University Ames, Iowa	Graduate and postdoctoral fellowships, thesis research and undergraduate research participation.
Forest Products Laboratory Department of Agriculture Madison, Wis.	Proximity to and unusually close cooperation with University of Wisconsin.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

Organization[1]	Type of Activity
Joint Institute for Laboratory Astrophysics Boulder, Colo.	Complete assimilation of laboratory and university staff covering all facets of educational and research activities.
National Radio Astronomy Observatory Charlottsville, Va.	Located on the campus of the University of Virginia. Close cooperation with the Astronomy Department.
Pacific Southwest Forest and Range Experiment Station Berkeley, Calif.	Proximity to and long history of informal cooperation with University of California.
Atomic Energy Project University of Rochester Rochester, N.Y.	Graduate and postdoctoral fellowships, thesis research and undergraduate research participation in radiological physics, biology and medical fields.
Tropical Atlantic Biological Laboratory Bureau of Commercial Fisheries Miami, Florida	Joint education and research ventures to take advantage of highly specialized resources available to Laboratory and University of Miami.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

V. PERSONNEL INTERCHANGE

A. GENERAL SUMMARY OF OBJECTIVES AND BENEFITS

All organizations, particularly those oriented toward science and technology, depend upon the infusion of new talent to maintain their vitality. In the Federal laboratories, personnel interchange has frequently taken the form of a one-way road--flow-out--with a resulting decrease in the effectiveness of the Federal research and development effort. However, despite the constraints which make it difficult to maintain a reasonable balance between staff intake and staff outgo, a number of organizations have been particularly resourceful in devising mechanisms to facilitate a healthy level of personnel interchange that is essentially two-way in nature.

Two-way personnel interchange serves to:

1. facilitate the exchange of scientific information and encourage the exploration of new approaches and techniques and the examination and testing of new ideas;

2. contribute to the development and education of promising junior staff members and help the resident professional staff to keep vigorous and competitive;

3. improve the image of the laboratory as a dynamic intellectual center, and hence aid in the recruitment and retention of able personnel; and

4. strengthen the laboratory's ties with universities and industrial laboratories, leading to additional forms of consultation and collaboration, joint work ventures, educational programs, teaching, lecturing, and thesis research.

B. TYPES OF PROGRAMS

1. Short-Term Appointments in the Laboratory (Flow-In)

a. Description

There are many successful "flow-in" programs, particularly at the postdoctoral level, which do not rely on incidental interrelationships or visits by others to Federal laboratories, but rather establish work experiences of a year or more in which a fruitful cross-fertilization of ideas and approaches can take place. Various techniques are used by the laboratories to bring leading scholars, scientists, and other professional persons from universities and industry to work jointly with their Government scientists and engineers on matters which relate to their mission goals and to areas of broad national interest.

b. Specific Objectives and Benefits

The establishment of short-term appointments is a way of fostering mobility which benefits both receiving and sending institutions by enabling them to bring fresh thinking and approaches to bear upon their problems. The receiving institutions also gain by having their work forces augmented by high quality personnel. The sending organizations benefit by having their staffs revitalized by the various forms of training and work experiences obtained in organizations with different problems, experts and viewpoints.

c. Authority and Methodology

(1) Special Authority for Temporary Appointment of College Faculty Members. Agencies have been delegated authority by the Civil Service Commission to appoint college faculty members, for periods up to a year, to positions in the competitive service that are of a scientific, professional, analytical, employee development, or instructional nature. These appointments may be made without regard to most of the usual appointment procedures and requirements, although appointments to positions above grade GS-15 or the equivalent must have prior Civil Service Commission approval of qualifications (as do other positions of this level).

Agencies have also been delegated authority to make short-term appointments of college faculty members under Schedule A of the Civil Service regulations (Section 213.3102(o)). These appointments may be for not more than 130 working days a year and must be to positions of a scientific, professional, or analytical nature for which the appointees are especially qualified. Also, under Schedule A, Section 213.3102(p), graduate students may fill positions of this same type for up to a year, provided that the work performed is to be used as a basis for completing academic requirements. A second year may be authorized by the Civil Service Commission.

(2) General Authority for Temporary Appointment. Temporary appointments from Civil Service registers may be made for periods up to one year. If appropriate registers do not exist or are inadequate, agencies may request the Civil Service Commission to authorize the appointment of persons from outside the registers. Persons appointed from outside the registers still have to meet qualification requirements.

Professional, scientific, or technical experts may be hired on a consulting basis for up to 130 working days a year under Schedule A, Section 213.3102(k), of the Civil Service regulations. These appointments can be made without regard to the usual competitive rules and procedures.

(3) Special Authority for Appointments Beyond One Year. For interchanges lasting more than one year but no more than four years, the most appropriate appointment method generally available to agencies is term appointment. Positions may be filled through term appointments

if they are of a project nature and will terminate upon completion of the project. Use of the term appointment authority requires prior authorization by the Civil Service Commission after a finding that term appointments are, in fact, appropriate. Selections are usually made from registers, but the Commission may authorize appointments from outside the registers if the registers contain an insufficient number of eligibles. Where there is a demonstrated need for a number of specially qualified scientists and engineers to assist in launching or developing new areas of scientific interest, the Commission may authorize a "block" of appointments not to exceed a specified number.

Persons serving in term appointments are excluded from the Civil Service Retirement System (although they are under Social Security), but have greater benefits than temporary employees. For example, they are eligible for life insurance and health benefits coverage, may receive within-grade pay raises, and have certain limited promotion opportunities and removal protection. If they are appointed to positions in shortage occupations, they may have moving expenses to the first post of duty paid by the agency.

(4) "When Actually Employed" Appointments (WAE). "WAE" is a term commonly used to describe the employment of a person to work on other than a continuing full-time basis. It may include recurring seasonal employment, continuous intermittent employment, or alternating periods of full-time, part-time, and intermittent employment. Such persons may serve in the competitive service under temporary or career-conditional appointments, or under excepted appointments authorized by statute or Schedule A. In other words, "WAE" is not used in this report to describe a particular type of appointment defined in Civil Service regulations, but to identify various arrangements by which employees are not paid on a regular full-time annual basis but only for the actual periods during the year when they do work. A number of these appointment authorities applicable to scientific and engineering personnel are described elsewhere in this catalog.

One of the major users of WAE employment relationships is the Geological Survey. Detailed descriptions of the way WAE appointments are used in the Geological Survey may be found in the Federal Council for Science and Technology's report, "Education and the Federal Laboratories," and in the proceedings of the jointly sponsored FCST-ACE symposium, "Education and Federal Laboratory-University Relationships."

(5) National Research Council Research Associateship Programs. Two National Academy of Sciences-National Research Council types of programs available to Federal agencies are the Postdoctoral Research Associateship programs and the Resident Research (Postdoctoral and Senior Postdoctoral) Associateship programs. These programs were introduced at the National Bureau of Standards and the Naval Research Laboratory in 1955 in an effort to utilize the resources of these Federal laboratories for postdoctoral research and to provide further professional development of carefully selected recent recipients of the

Ph.D. degree. Since that time the number of participating agencies has grown to 20 and a variety of practices has grown up among the programs. For example:

- While most of the programs are limited to citizens of the United States, those of the Agricultural Research Service, Air Force Office of Aerospace Research, Army Natick Laboratory, NASA, Naval Medical Research Institute and Smithsonian Institution also welcome applications from foreign nationals. New appointments in the NASA program in 1968 were almost equally divided between U.S. citizens and foreign nationals.

- Most of the programs are limited to very recent recipients of the doctorate. However, those of the Office of Aerospace Research, Army Natick Laboratory, NASA and the Smithsonian Institution welcome applications from senior investigators and offer suitably larger stipends to such individuals.

- Most of the programs have an annual competition, but selections are made on a quarterly basis for appointments at the Army Natick Laboratory, NASA and the Smithsonian Astrophysical Observatory.

The NRC Office of Scientific Personnel announces the programs to the academic and research community and receives applications which are evaluated by an NRC selection panel. Participants in these programs are attracted to the opportunities offered by working with outstanding Federal scientists and using special equipment and facilities available in the Federal laboratory setting.

Successful candidates in the Postdoctoral Research Associateship programs are appointed on a temporary basis by the Federal laboratories at grade GS-12 or above under Schedule A, Section 213.3102(aa), of the Civil Service regulations. Appointments are for one year but may be extended for up to one additional year.

Successful candidates in the Resident Research Associateship programs are appointed by the National Research Council and are not Federal employees. Recent postdoctorals receive a stipend comparable to GS-12. Senior appointees receive stipends set after consideration of their present salary.

Many Research Associates remain with the laboratories by accepting continuing permanent appointments. Those who return to university posts indirectly contribute to the laboratories' R&D effectiveness by providing new campus contacts for the host laboratories.

(6) Other Research Associate and Fellowship Programs.

(a) Several laboratories make their equipment, facilities and other resources available to visiting scientists and guest workers to carry on a specific project or to participate and collaborate with the laboratory staff either on programs already established or on new R&D endeavors. Visitors from universities, industrial corporations, and trade associations may work for periods of from one week to two years. There are a variety of arrangements concerning selection procedures, personnel liability, publication of the work, etc. Normally, the investigator will be sponsored by another organization and will work on a project of mutual interest which has been approved by the laboratory. Salaries, travel and the pro rata share of overhead costs are borne by the sponsoring organization.

Programs of this nature rest on two legal bases--a Joint Congressional Resolution of April 12, 1892, 27 Stat. 395, and an Act of March 3, 1901, 31 Stat. 1039. (See also 20 U.S.C. 91.) The statutes provide that facilities for study, research, and illustration in Government departments shall be afforded to scientific investigators and to duly qualified individuals, students and graduates of institutions of learning in the several States and Territories, as well as in the District of Columbia, under such rules and restrictions as the heads of departments and bureaus may prescribe.

(b) Sabbaticals: Several laboratories make appointment arrangements with university staff members on sabbatical leave. University personnel may receive remuneration from their university concurrently while receiving Federal remuneration, which greatly enhances the ability of the laboratories to attract outstanding scientists from the university sector.

University staff traditionally select other universities for their sabbatical residence. Where this is the case, laboratories sometimes can work out arrangements where half of their time is spent in residency at the laboratory. This has the effect of avoiding any stigma or loss of prestige that might arise by departing from established patterns.

(c) Summer faculty programs: Several programs are based upon three-way cooperation involving national professional societies, universities, and Federal laboratories. The NASA Summer Faculty Program involving The American Society for Engineering Education is an excellent example of cooperation of this type. In this program the ASEE recruits the faculty members. The universities and NASA Centers select the participants, matching the research interests of the NASA laboratories with the individuals. Engineering and science faculty members are able to gain firsthand knowledge about the latest practical problems and developments by participating as members of a study project. During his summer "internship" each Fellow works with a laboratory colleague, while also participating in seminars and lectures. They return to their home universities with new concepts and ideas leading to improved teaching and research.

(d) There are many additional types of programs involving fellowships, cooperative work-study programs, graduate training, etc.

For example, the Forest Products Laboratory, Madison, Wisconsin, offers career-conditional, part-time employment to university graduate students, with thesis work as part of the job description and salaries paralleling those of a university fellowship. Appointments are at the GS-7 grade for those working toward the masters, and at GS-9 for Ph.D. candidates. The student-employee is expected to work enough hours to earn $2,700, which is the present stipend for university research assistants. The thesis advisor is a laboratory staff man. This mechanism attracts a high calibre of students to the university and gives the laboratory a quality back-up staff to assist in its research studies. Many of these student-employees eventually become permanent members of the laboratory staff.

d. Partial List of Organizations with Effective "Flow-In" Programs

Organization[1]	Type of Activity
Division of Nuclear Education and Training Atomic Energy Commission Washington, D.C.	Administers and coordinates a variety of educational and research activities for faculty, graduate students, and undergraduate students at ten AEC laboratories.
Forest Products Laboratory Forest Service, USDA Madison, Wis.	Many types of programs involving research associates, cooperative work-study programs, graduate training, etc.
Associate Director for Academic Liaison National Bureau of Standards Washington, D.C.	An active postdoctoral research associateship program since 1955.
Office of Scientific Personnel National Research Council Washington, D.C.	Operates and coordinates the NRC Research Associateship Programs with 20 participating laboratories.
Director, Sustaining University Program Office of University Affairs NASA Washington, D.C.	Coordinates with NRC the Research Associateship Programs with participating Research Centers. Operates summer faculty fellowship programs in aeronautics and space research and engineering systems design.
Office of the Chief Geologist U.S. Geological Survey Washington, D.C.	Wide use of WAE type appointments.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed. Other pertinent contacts are the National Centers of the NSF.

2. Assignments Outside the Laboratory (Flow-Out)

a. Description

Temporary assignments of laboratory staff members are made to other organizations where they can collaborate with outstanding scientists on mutual problems. These assignments may take the form of fellowships, details, transfers, temporary change in duty station, and long-term graduate or postdoctoral training.

b. Specific Objectives and Benefits

Senior scientists and other professionals benefit greatly from periodic exposure to different viewpoints and experiences as found in other environments for the purpose of broadening their outlooks and enhancing their professional skills. Frequently, the accomplishment of a research or technological study requires that a person work with colleagues in other environments to become familiar with the latest advances and thinking in selected areas of science. In many instances, flow-out programs may serve the intent of sabbaticals.

c. Authority and Methodology

(1) Change in Duty Stations. One of the most effective and flexible devices for disengaging laboratory personnel from their regular assignments to receive refresher and other work-related experiences is the authority available to change a person's duty station to another institution. This technique is especially valuable because it permits the payment of per diem during an initial adjustment period, as well as travel expenses and the cost of moving household effects.

(2) Temporary Duty Orders. Authority exists to pay per diem under the Government travel regulations, during temporary duty assignments to locations other than employees' official duty stations. The amount of per diem payable is usually on a reduction schedule rate, with full per diem for the first 30 days and a lesser amount for each additional 30 days.

(3) Long-Term Graduate and Postdoctoral Training. Many organizations utilize the provisions of the Government Employees Training Act to provide up to a year of full-time training away from the laboratory. Training may include course work or joint work assignments and consultation designed to assist the participant in acquiring competence necessary to attack problems more effectively. Depending upon the purpose and nature of the training, a useful guideline is for organizations to work out appropriate arrangements for the payment of per diem, travel, and other expenses on a "no-gain, no-loss" basis to the employee.

(4) Leave Without Pay. The variety of arrangements for establishing effective, temporary "flow-out" programs is relatively limited. Some organizations encourage the taking of leave without pay,

for periods ranging up to three years, by employees seeking advanced degrees or wishing to accept faculty positions with universities. Employees are encouraged to take advantage of fellowships, traineeships, and assistantships to advance their technical and management knowledge, and to accept teaching and research positions.

d. Partial List of Organizations Having Effective "Flow-Out" Programs

Organization[1]	Type of Activity
National Communicable Disease Center, HEW Atlanta, Ga.	Thirty-five to forty staff members annually receive long-term training aimed at completing requirements for advanced degrees or board certification in medicine.
Deputy Director for Science National Institutes of Health Bethesda, Md.	Use of change-in-duty-station procedure to permit senior staff members to work with distinguished scientists in universities throughout the world.
Assistant Administrator for University Affairs Office of University Affairs NASA Washington, D.C.	Policy statement on use of leave without pay.
Office of the Director U.S. Geological Survey Washington, D.C.	Use of change-in-duty-stations and temporary duty assignments.

3. Personnel Interchange (Two-Way)

a. Description

In areas of parallel effort and functions between Federal and non-Federal laboratories, there is a common basis for mutual exchanges, where man-for-man exchanges and the reciprocal use of equipment and services should occur as a matter of course. Cooperative agreements can be designed to accommodate the administrative and functional requirements peculiar to each organization. A number of the techniques available to facilitate flow-in and flow-out have been described. Others, which emphasize a continuing interaction and exchange as part of formalized agreements, are discussed below.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

b. Specific Objectives and Benefits

Two-way personnel interchange provides a means for employee renewal and organizational vigor. The exchange of personnel enlarges the knowledge and skills of the participants, stimulates others with whom they come in contact in both organizations, and paves the way for future dividends by laying the groundwork for fruitful collaborative and educational efforts.

c. Authority and Methodology

(1) Cooperative Agreements for Mutual Exchanges and Sharing of Equipment. Laboratory-university interchange can be established by means of cooperative agreements entered into under general statutory authority to make Government facilities available to others for research study. Because of the mutually beneficial nature of the relationship, exchanges of funds between the parties can be greatly minimized and university faculty and students are afforded an opportunity to work on problems of immediate interest to the laboratory.

(2) Joint Staff Appointments. Agreements to make joint appointments of the members of a university and the laboratory to the staff of each organization is a particularly effective way to facilitate interaction and joint work activities. These agreements sometimes begin with the listing of laboratory staff members in college catalogues or in meeting and seminar calendars that are made available to college faculty and students. Complete intermixing and continuing exchange of university and laboratory staff members occur at the Joint Institute for Laboratory Astrophysics, the National Center for Atmospheric Research, the Argonne National Laboratory, the Brookhaven National Laboratory, and many federally related contract laboratories.

(3) Informal Cooperative Programs. The Goddard Institute for Space Studies in New York offers an example of a cooperative program based on informal arrangements. It has a small, permanent staff that works closely with neighboring universities to develop maximum university contributions to the space science program. Associations between the Institute and New York area universities are an integral part of Institute operations and constitute a significant source of strength and vitality in the Goddard program. The most important element in these associations is the fact that a substantial number of graduate students perform research in space sciences on the Goddard premises under the guidance of Institute staff members who hold adjunct faculty appointments in the New York area universities. These appointments enable Institute staff members to offer courses in space science in neighboring universities and to supervise Ph.D. research by graduate students working in the space-related fields. The courses enable Institute staff members to interest students in doing graduate work toward the Ph.D. degree on space science topics. In 1967-68, 16 courses were offered by Institute staff members at universities in the New York Metropolitan Area.

(4) Pending Legislation. Hearings are currently in progress (summer of 1969) on the proposed Intergovernmental Personnel Act of 1969, which is primarily aimed at interchange between Federal, state, and local governments. This would provide for formal interchange arrangements between Federal, state, and local governments, and public and private universities, with full protection of such rights and benefits as health and life insurance, sick leave, and retirement benefits for Federal employees during the periods of exchange.

d. Partial List of Organizations Having Considerable Two-Way Personnel Exchange

Organization[1]	Type of Activity
Goddard Institute for Space Studies NASA New York, N.Y.	Institute personnel hold adjunct university appointments and teach regular courses at the university. Graduate students conduct research at the Institute.
Joint Institute for Laboratory Astrophysics Boulder, Colo.	Complete intermixing of Federal and university staff members, teaching, and work activities.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

VI. EQUIPMENT INTERCHANGE

A. DESCRIPTION

The amount of interchange between Federal laboratories and universities depends largely on the competency of the staffs and the excellence of equipment and facilities in the cooperating institutions. Just as outstanding scientists and engineers characteristically collaborate with each other without regard to organizational boundaries, so the presence of unusual experimental equipment or highly specialized facilities serves to stimulate the cross-utilization of organizational resources.

In many instances, equipment and facilities that cost millions of dollars cannot and should not be duplicated by all organizations having related interests. Since the special facilities available at some universities and many Federal laboratories are beyond the means of most organizations, they constitute a key factor in attracting scientists from outside the parent organization. Equipment interchange and sharing is a way of life in some organizations and takes place in an atmosphere of active interplay between the cooperating parties.

The sharing of equipment through informal or formal arrangements as a matter of national policy has taken a variety of forms. These are largely determined by the nature of the work, cost, and demands placed on the use of the equipment by laboratory and other staff members.

1. Unique, Unusual, and Expensive-To-Duplicate Equipment

The sharing of equipment that is costly and difficult to duplicate is automatically limited by the scarcity of such equipment and the heavy current demands for its use. Despite these constraints, several agencies have a long history of extending the use of equipment of this type to university faculty and their students. Examples include the following:

a. Many of NASA's space research and sounding rocket facilities have been developed and used to launch experiments in which the scientific community, especially college and university researchers, has been able to participate extensively. Most of the experiments involved in earth orbital launches have been of this nature.

b. Another NASA installation makes its cyclotron available to a consortium of five universities for use about 50 percent of the time.

c. Several NASA laboratories place their wind tunnels at the disposal of university and other groups for experimental and testing purposes.

d. Defense laboratories have provided the National Science Foundation and various universities working under NSF sponsorship with varying forms of support and equipment assistance during expeditions such as the Pacific and South American eclipses of 1965/1966, and during the International Quiet Solar Year and International Geophysical Year.

e. The Naval Research Laboratory in Washington, D.C., has a cyclotron, a linear accelerator, a Van de Graaff generator and other facilities that are made available to and used by university graduate students and faculty members.

f. An Army laboratory permits use of a linear accelerator and climatic research chamber by a number of universities.

g. Another Army laboratory allows universities access to a two million pound tensile/compression machine and a nuclear reactor.

h. Army and Air Force laboratories provide universities with use of their cold room laboratories and field station facilities.

i. One of the world's best astrometric telescopes, at the Flagstaff, Arizona, station of the U.S. Naval Observatory, is used extensively by other observatories, by university faculty and graduate students, and by other long-term visitors.

j. An Interior laboratory located on a university campus has a renowned collection of shark specimens and specialized equipment that are used extensively by the university staff.

k. Federal oceanographic research vessels and shore facilities are used regularly each year by a number of university people, and more could be accommodated. Research cruise schedules, including notice of space available, are listed annually in a pamphlet issued by the Interagency Committee on Oceanography.

l. A Forest Service laboratory has two of the only three specially designed electron microscopes available in the world for wood analysis. These are traditionally shared with university scientists and others for research purposes. This laboratory's collection of wood and pulp samples, the most complete in the world, is made available to others.

m. Agricultural Research Service laboratories have the world's best collections of parasites and bacterial cultures. These are made available to universities and others for research purposes, and attract investigators from all parts of the world.

n. All of AEC's major research and development facilities are contractor-operated installations. Participation by visitors or "non-permanent" employees of the contractor in the activities at the various AEC (government-owned) facilities is significant and can be compared, in kind, to participation by non-Government scientists in work at federally operated laboratories.

(1) The most significant participation occurs at AEC's six multi-program laboratories[1] and at some of the large accelerator installations. Some of the latter, such as the Stanford Linear Accelerator Center (SLAC), were established as national research centers, and a large proportion of the research at such installations is performed by visiting scientists.

(2) Under cooperative research arrangements, university research workers can avail themselves of the major research tools at AEC's research groups under AEC contract. Based on mutual interest, groups financed by private or state funds or by other Federal agencies may make arrangements to use the equipment at these laboratories. Some dramatic examples of this practice are the use of major accelerators such as the alternating gradient synchrotron at the Brookhaven National Laboratory, and the zero gradient synchrotron at Argonne National Laboratory. There exist throughout the country a large number of "user groups" that formulate experiments, secure time on a major machine, gather their data, and return to their campuses to analyze the results.

o. The National Research Centers operated under contract with the National Science Foundation make specialized facilities available to qualified members of the scientific community. These facilities include optical telescopes, radio telescopes, and aircraft and radar sets which have been specially modified for atmospheric research.

p. One type of Government-wide facility frequently used by university workers is automatic data processing systems and equipment. This type of interchange is frequently two-way in that many Federal laboratories make use of computer facilities at colleges and universities.

2. Other Forms of Equipment Sharing

The use by others of Federal facilities and equipment not distinguished as unique or costly represents an even more substantial and characteristic pattern of association of Federal laboratories with the academic world. Here, the use of equipment is often two-way in that university and other non-Federal equipment is used by those in the Federal setting. Such mutual and complementary equipment-sharing programs are part of long-established habit patterns at many installations for fostering maximum interaction with scientists from all sectors of the R&D community.

Where there is conscious reciprocal use of equipment, arrangements are generally handled on an informal basis with little if any financial charge. Often the laboratory considers advancement of the science in its field to be an integral part of its overall mission, and to this end cooperates extensively with appropriate universities in the use of personnel, equipment, and other facilities.

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[1] Argonne National Laboratory, Oak Ridge National Laboratory, Brookhaven National Laboratory, Los Alamos Scientific Laboratory, Ames Laboratory, and Lawrence Radiation Laboratory.

a. The Joint Institute for Laboratory Astrophysics, the Geological Survey at Menlo Park, the Brookhaven National Laboratory, the Bureau of Commercial Fisheries Tropical Atlantic Biological Laboratory, and the Forest Products Laboratory at Madison, Wisconsin, are examples of this close day-to-day cooperation. At the BCF Laboratory, space and facilities are continuously made available for research purposes by visiting scientists, from both the United States and foreign nations.

b. The relationship between the Department of Agriculture and state universities generates many excellent examples of shared equipment and personnel. In some instances, the on-campus installations belong entirely to the Federal Government. In other cases, the Federal employees work in state-owned facilities. Again, facilities and personnel may be state-owned, while partial support is provided either from matching Federal and state funds or through USDA contracts and grants.

B. OBJECTIVES AND BENEFITS

The sharing of equipment increases scientist-to-scientist communication, with many by-product results in the form of joint work efforts, personnel interchange and exchange of knowledge and information. It increases joint understanding and appreciation of university and Federal laboratory goals and missions, and, hopefully, contributes to mutual respect and the improvement of attitudinal and other factors which impede the development of strengthened relationships.

Equipment sharing increases cooperation in educational and training areas by making available a large number of research-oriented studies and experimental facilities for graduate students and faculty members. By making special and expensive-to-duplicate facilities available to the scientific community, Federal laboratories help augment the national capability for attacking and solving research or development problems.

C. AUTHORITY AND METHODOLOGY

On February 21, 1969, the President issued a policy guideline and instructions endorsing expanded use of Federal research facilities by university investigators. Departments and agencies were encouraged to implement the intent and substance of this statement by issuing positive instructions that would facilitate greater activity in equipment sharing.

In general, the criteria for use of Federal facilities and equipment should be sufficiently flexible to encourage the fullest possible contribution to agency R&D missions and related national educational needs. However, application of this policy is not intended to take precedence over the accomplishment of a laboratory's mission. Where a laboratory is already using its facilities to the extent that it is exceeding the practical limits of its machine time, funds, and manpower, a determination should be made that the proposed research is both consistent with the laboratory mission and will not adversely affect essential on-going programs.

The recently approved policy, and implementing instructions directing Federal agencies to make certain laboratory facilities available to academic scientists and engineers, read as follows:

Policy on Expanded Use of Federal Research Facilities by University Investigators

> "Unique, unusual, and expensive-to-duplicate facilities at Federal laboratories and federally-supported research centers should be made available to the national scientific community to the maximum extent practical without serious detriment to laboratory missions, especially to qualified academic scientists and engineers. Criteria for such use should be the scientific merit of the proposed experiment, its relation to the agency research mission, and its contribution to national research and research training.
>
> "When such facilities are used by academic scientists and engineers, the costs incurred by the laboratory or center for the operation of its unique or unusual research facilities should be funded by the agency responsible for the operation of that facility, except for any significant incremental costs incurred in support of research not directly related to the agency's mission. The research costs incurred at the experimenter's home institution and significant costs for specialized equipment fabricated at the center primarily for use by the particular experimenter should normally be borne by the granting agency, the home institution, and/or other sponsoring organization. However, when the research is sufficiently related or useful to the host agency's responsibility, these costs may be borne by the agency responsible for operation of the center."

Implementing Instructions

> "1. Departments and agencies should delegate authority for negotiations and decisions as to the use of Federal facilities by outside groups to local laboratory directors to the maximum extent possible, with such actions remaining as flexible and informal as responsible practice would indicate. Directors should be encouraged to make appropriate use of advisory groups in formulating their decisions.
>
> "2. When programs for non-government use of Federal facilities are expanded, department and agency officials should be prepared to assist laboratory directors obtain correspondingly increased staff and budget allocations.
>
> "3. Federal laboratory officials should seek agreements, executed by non-government users, absolving the Federal agency

of liability in case of personal injury, death, and failure or dmanage to experiments or equipment."

D. PARTIAL LIST OF ORGANIZATIONS THAT HAVE MAJOR EQUIPMENT-SHARING PROGRAMS

Organization[1]	Type of Activity
Director, Ames Research Center NASA Moffett Field, Calif.	Wind tunnels for experimental and testing purposes.
Division of Nuclear Education and Training Atomic Energy Commission Washington, D.C.	Coordinates the Commission's Education and Training programs for equipment and facility sharing at all major AEC laboratories.
Associate Director Langley Research Center, NASA Hampton, Va.	Cyclotron Available for university use.
Naval Research Laboratory Washington, D.C.	Encourages use of the Laboratory's unique facilities by qualified university scientists and engineers.
Director, Wallops Station NASA Wallops Island, Va.	Sounding rockets; payload development and launch facilities.
Kitt Peak National Observatory Tucson, Ariz.	Optical telescopes and other specialized facilities available to qualified members of the scientific community.
National Center for Atmospheric Research Boulder, Colo.	Specialized facilities, equipment and vehicles available to qualified members of the scientific community.
National Radio Astronomy Observatory Charlottsville, Va.	Radio telescopes and other specialized facilities available to qualified members of the scientific community.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

VII. CURRICULUM

A. DESCRIPTION

As the largest and most pervasive institution in the Nation, the Federal Government exerts an extraordinary and increasing influence on society. Its influence upon the academic community is effected not only by the more than $3.4 billion that it provided to higher education in FY 1968, but even more importantly through its capacity to establish national objectives. The latter determine, to a large extent, many of the Nation's professional and intellectual demands for which the Federal Government bears some responsibility. For the universities, the consequences of such direct and indirect Federal efforts have been translated into a vastly expanded educational plant, new and improved training programs, an enlarged research effort, and the provision of a variety of public services. Many of these considerations affect curriculum changes and development.

While the largest proportion of Federal funds has been directed toward encouraging the physical and life sciences, support is extended to almost all areas and ranges from engineering and agriculture to the arts and humanities. The knowledge produced has been translated into technology and has contributed to specialization and differentiation of the total knowledge structure.

Other institutions, including industry, also have become involved in this process and have added to the store of knowledge. To meet their educational objectives the universities have been pressed to stay abreast of the many advances--especially those in science and technology--that have come about in just the last two decades. To maintain adequate and relevant programs the academic enterprise has found it necessary to reexamine curricula on a continuing basis. Because of long association during the years based on mutual interest and respect, Federal agencies such as the National Bureau of Standards, the National Institutes of Health, and the Geological Survey have been particularly helpful to universities in this respect.

In FY 1968, the National Science Foundation made grants in excess of $6 million for science curriculum improvements. These covered such diverse fields as agriculture and natural resources, biology, chemistry, engineering, geography, geology, mathematics, and physics. Also, in a study of the Office of Education by the House Committee on Education and Labor, issued in 1968, it was stated that the Curriculum Development Branch of the Division of Higher Education Research was supporting 62 projects concerned with curriculum and hardware development. Such efforts focus mainly on the higher educational level, and are chiefly concerned with undergraduate education.

At the graduate level, attempts at curriculum aid have been more limited, since curricula are in large part determined not by the communication of information but by the character of the research opportunity and its pursuit. To this extent, Federal support has been given to a large number of research efforts, both large and small, that have in considerable measure determined the present character of university curricula and research orientation.

The provision of Federal funds for the pursuit of research is only one factor affecting the evolution of academic curricula. Another increasingly effective approach involves direct cooperative Federal laboratory-university arrangements for the incorporation of new content or concepts into academic curricula. Many of these have come about as a result of initiative by a Federal agency. There is every reason for such initiatives to be shared by the universities.

B. OBJECTIVES AND BENEFITS

The objective of two-way participation involving curriculum planning is to bolster the Nation's ability to deal effectively with emerging fields of science and technology. One group alone frequently will not have the specialized competence to determine the form and amount of training that is needed to keep pace with stepped-up activities in the many new areas, particularly those which demand an interdisciplinary approach.

The benefit to individual laboratories that provide assistance to curriculum development in the form of expertise, equipment, facilities and/or financial support lies in the provision of a reservoir of appropriately trained personnel who will be needed for effective pursuit of its mission.

C. AUTHORITY AND METHODOLOGY[1]

A number of agencies such as the Atomic Energy Commission, Department of Health, Education and Welfare, National Aeronautics and Space Administration, National Science Foundation, and the Veterans Administration provide direct support of research and development, as part of their congressional mandates, by sponsoring grants, training fellowships, contracts, research facility construction, etc. These agencies depend upon study groups, national councils, and other advisory committees to compare the present capacity for training with future manpower needs in their fields of interest. Implicit in Federal support of academic and industrial research is the responsibility for reviewing accomplishments over a period of years, including the most promising recent developments, and determining which problems remain unsolved and which might be attacked more effectively by providing additional forms of education and training. These activities have a profound influence on curricula, since they are primarily focused on the development of manpower to meet both current and future needs.

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[1] See also "Curriculum Assistance" on page 18.

A number of successful Federal laboratory-university cooperative programs have led to the incorporation of new or greatly modified courses into academic curricula. For example, the Training Institute of the Environmental Control Administration, in Cincinnati, presents short-term courses with laboratory work and field exercises, that have been developed in response to needs expressed by state governments and other groups. In developing these programs, the Institute has prepared many textbooks introducing new concepts and approaches. These are made available to universities, state governments, and industry. The NASA Ames Research Center and the Federal Water Pollution Control Administration are other agencies that have assisted in the development of texts and course materials in connection with technical education programs. Through short courses and training manuals developed at the Special Training Division, Oak Ridge Associated Universities, numerous colleges and universities have upgraded and initiated new courses in nuclear science and technology.

In cooperation with Stanford University, NASA's Ames Research Center has set up a summer course on systems engineering. The course, taught jointly by Stanford and Ames personnel, provides demonstrations and practical experience. The students are faculty members from throughout the country, awarded fellowships by the university primarily to take this course. This is a contract type operation. Similar programs are conducted at the Manned Spacecraft Center at Houston with the University of Houston and Rice University; the Marshall Space Flight Center at Huntsville with Auburn University and the University of Alabama; and the Langley Research Center at Hampton, Virginia, with Old Dominion College.

In such new fields as engineering with nuclear explosives and fast reactor technology, universities have worked closely with the appropriate AEC laboratory to develop new curricula and graduate programs.

The Federal Water Pollution Control Administration has prepared a variety of laboratory manuals, course outlines, and other teaching materials for use throughout the country.

Until recently there were no college level programs in the multidisciplinary field of hydrology. The University of Arizona, cooperating with the Geological Survey, developed curricula, courses, and teaching competence, to provide for undergraduate and graduate level degree programs. Initially, the Geological Survey made its own staff available to assist in curriculum planning and teaching. Survey staff also participated as part-time and full-time students. The degrees are now being offered also by other universities.

In the Miami (Florida) area, both the universities and Federal laboratories are meeting the challenge of such new disciplines as oceanography. The University of Miami realized sometime ago that it could not continue to expand its marine facility indefinitely; it felt that it was creating too much of a monolithic structure and that what was needed was a community of laboratories. With the City of Miami's cooperation the Island of Virginia Key was set aside for marine science activities. The University was able to attract to this area the Bureau of Commercial Fisheries Biological Laboratory as well as an Envrionmental Science Services Administration laboratory that has not yet been constructed. Thus it is hoped to establish Virginia Key as a sort of Woods Hole of the South. In this case there will be a community of laboratories approach to marine sciences. Qualified persons in these other institutions are added to the professorial ranks and have every privilege of the faculty of the University of Miami except those of tenure and voting on certain issues related to tenure.

D. PARTIAL LIST OF ORGANIZATIONS WHICH HAVE AFFECTED CURRICULUM DEVELOPMENT

Organization[1]	Type of Activity
Lawrence Radiation Laboratory Livermore, Calif. and Stanford University Stanford, Calif.	Nuclear Civil Engineering.
Training Officer National Bureau of Standards Washington, D.C. and The George Washington University Washington, D.C.	Establishment of a university program in metrology.
Director Sustaining University Program Office of University Affairs NASA Washington, D.C.	Operates and coordinates engineering systems design summer program with participating NASA centers and cooperating universities. Operates and coordinates summer faculty fellowship program in aeronautical and space research at NASA research centers.
Smithsonian Institution Washington, D.C.	Classification of life science objects. Cooperation with a number of universities.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

VIII. USE OF TELEVISION AND OTHER AUDIOVISUAL AIDS

A. DESCRIPTION

One of the most effective partnerships between Federal laboratories and universities or other learning centers is that aimed at continuing education. The proper use of audiovisuals holds the key to the success of this relationship. Geographical isolation of laboratories from centers of education is no longer a sufficient reason for educational isolation of the laboratory staff.

Electronic transmission of educational materials can now be so simple and so complete as to obviate the need for physical closeness of student and teacher. Several laboratories have bridged the isolation gap by using television to link the laboratory staff, faculty and students, and its experimental facilities with university operations. Where electronic transmission is not appropriate, say, as in the case of on-site use of slides or films, then requests and responses by fast mail services can satisfy the needs of the laboratory.

Experience has shown that generally it is in the best interests of laboratory effectiveness if continuing education courses can be provided to personnel on-site. It has always been difficult to justify periods of absence for professional staff to attend courses at remote universities. It is equally difficult for individuals to find adequate time outside of their generally long working hours to attend courses at nearby universities or centers of learning.

An increasing number of laboratories are finding it advantageous to use audiovisuals and electronic communications to provide instruction on-site and during working hours. This has been best effected through partnerships between universities and the laboratories. The universities provide the teachers and the educational material. The laboratories provide the students and necessary on-site equipment. Mutual agreements are made as to course curricula, hours, university credits and funding of university equipment and communications links.

B. OBJECTIVES AND BENEFITS

The objectives of Federal laboratories in insuring against the technological obsolescence of their professional staffs include (1) providing continuing education in the most convenient environment, which is generally on-site and during working hours, (2) making the instruction as individualized as possible, (3) providing means for self-pacing and self-evaluation on the part of individual staff members, and (4) providing formal recognition of successful course completion through certificates of achievement and the like.

The technology that achieves the benefits of removal of geographical constraints on availability of education, on quality of education, more individualization of learning, a lessening of economic burdens on educational institutions and a better cost-output education ratio for Federal laboratories is the "big" technology of audiovisuals, communications, closed circuit television, computers and computer-communications coupling. This includes educational television (ETV), instructional television (ITV), films, listening laboratories and audio tapes, programmed instruction, mediated self-instruction, computer aided instruction (CAI), multimedia audiovisual facilities, telelectures and remote group assisted instruction. The phraseology "integrated media" is frequently used to describe these innovations in the use of audiovisuals for instructional purposes.

Closed circuit television tie-ins between laboratories and universities serve to erase the isolation gap by facilitating the giving of undergraduate and graduate courses, seminars, workshops, etc., when small numbers of people are enrolled at a number of geographically separated locations. The potential of TV for improving scientist-to-scientist communications is virtually unlimited. With the rapid advances in technology, published research often becomes obsolete before it is made available in scientific journals and the textbooks. TV provides a means for greatly accelerating the flow of scientific information. Laboratories and universities are just beginning to exploit the many advantages of TV as a teaching and learning media.

In many instances the role of computers is a controlling factor in decisions. Computer considerations dominate discussions of CAI or computer generated movies. Communications networks to permit sharing of educational information banks or programs are often dependent on the availability of computers to manage network operations. In the case of CAI, the coupling of computers and communications is essential. In the case of computer-generated movies it is not.

C. AUTHORITY AND METHODOLOGY

The subsequent paragraphs describe briefly those educational media available and rather widely used which lend themselves to the needs of Federal laboratories.

1. Television

Although there is a seemingly infinite number of specific applications for instructional television, there are three basic methods of use. First, it can be used as a substitute for "live" presentations in a large auditorium; second, to magnify real-life situations or to broadcast microscopic demonstrations and surgical operations so that large numbers of students may view a single visual production; and, finally, to provide instruction to receivers in locations where it is not feasible to staff a given course, or where the specific contribution of some noted lecturer-demonstrator is desired. Some of the most interesting uses of television are those that allow the student to see events that would otherwise be inaccessible or unobservable, or where the presence of observers would introduce distracting or contaminative elements into the event under study.

Following is a description of an innovative program established by the University of Florida to provide a special state television network for offering engineering education.

> A Graduate Engineering Education System (GENESYS) program has been developed to implement legislation passed by the Florida legislature in 1963, and to provide for the establishment of an extension of the College of Engineering of the University of Florida to east-central Florida. The plan includes five operating facilities: Orlando, Cape Kennedy, Daytona Beach, Melbourne, and the University of Florida campus at Gainesville. In all locations, about 70 percent of the instruction is performed by live instructors in the conventional classroom approach. In addition, all five terminals are interconnected by closed circuit, talk-back TV, to provide instruction in specialized courses to small numbers of students at all reception points. Through this arrangement, students can ask questions of the professor during the TV lecture, and the students at all locations hear all such questions and answers.
>
> With this system it is possible for a professor, recruited from any point in the network area, to originate a course that might be taken by as few as two or more students at any one of the five receiving points. In this way it is possible to offer courses in highly specialized subjects to small numbers of students over a broad geographical area. Class enrollment on the network might total only 20 to 25 students, or less. Proponents of the plan believe that the TV instruction offers a choice not only of comparative costs, but also as to whether a diversified program can be given at all. The television network is reserved for use, in the main, to teaching highly specialized, low-enrollment courses, or for cases where the only available faculty member is separated from the student body by a long distance.
>
> Administratively, GENESYS is an administrative and educational arm of the University of Florida's College of Engineering, reaching out to serve the post-graduate educational needs of engineers and scientists in east-central Florida. It provides the mechanism and personnel for direct contact between these potential students and the 12 academic departments of the College. Administrative procedures and practices are those of the University of Florida, the College of Engineering, and the Engineering and Industrial Experiment Station. The administration of admission, student records, and similar matters is handled by an Assistant Director of Admissions, located in the Office of the Registrar in the University of Florida at Gainesville.

The Florida University College of Engineering offers three graduate degrees to resident students on the Gainesville campus--the Master of Engineering, Master of Science, and Doctor of Philosophy. Because GENESYS is a part of the resident campus, all three degrees currently available in Gainesville are also available at the receiving locations through GENESYS in all subject areas, under circumstances applicable to Gainesville. Additionally, the GENESYS plan anticipates that post-baccalaureate, non-degree programs aimed at professional improvement of engineers will be provided. This type of offering may take the form of courses following a traditional schedule, or short courses, or seminars. This technique allows an individual employer to tap the University TV network and provide an in-plant receiving point for TV courses. Under these circumstances, employees can be released at any time during the day to attend courses in the plant without excessive loss of time away from duties. This arrangement permits the enrollment of many students who would otherwise be excluded from organized instruction.

This concept of broadening coverage has been implemented at the Kennedy Space Center. The TV network extending from Orlando to Cape Kennedy, passes directly over the Merritt Island Launch Area. NASA has decided to introduce a tap on the network at that point and to provide TV course-receiving facilities directly at the Merritt Island site. This approach will bring many NASA engineers and scientists into courses who would otherwise have been excluded. The Air Force also has decided to tap the TV network and provide course-receiving facilities on the premises of nearby Patrick Air Force Base.

2. Films

Motion picture film has had a 40-year history of use in the Nation's classrooms and still makes an important contribution to instruction. Film is durable, available in a great range of titles and subjects, may be rented at very low cost or purchased at about the same cost as a blank videotape of comparable running time, and can be run on inexpensive equipment that is very easy to operate. Its disadvantages are that it cannot be corrected or updated as rapidly and simply as videotape, it sometimes poses scheduling problems if it must be rented from off-campus agencies, and it involves an amount of annoying labor to assemble and set up the film, the projector, and the screen.

Several efforts are underway to improve the utility of films for educational purposes. Some efforts are aimed at improving the flexibility of films by producing a series of 30-minute films each of which summarizes a major concept in a single field such as communications. Specifically identified, semi-independent five-minute segments of these films may be used as stimulants to discussion or research. The films are carefully planned to raise fundamental problems, and not to simply give the final answers for repetition at test time.

Another useful innovation is the five to ten minute 8 mm cartridge-contained "single-concept" film loop which is easy to use and which has wide application to independent study. There is also a great deal of interest in the 8 mm cartridge projection including the "Super 8" format which provides superior picture quality coupled with magnetic or optical sound track systems.

3. Listening Laboratories and Audio Tapes

The listening laboratory is perhaps the most successful and widely used of the many new media now available to higher education. The audio tape is ideal for self-instructional programs such as music and foreign languages and may be simply and conveniently used, reproduced or duplicated. The conventional listening laboratory is a facility for the study of foreign languages. It usually contains from 24-60 student booths, each equipped with a tape recorder capable of duplicating, playback, listen/record, and audio-lingual testing.

A more recent adaptation of the listening laboratory is the random-access system which emphasizes individual study. In this type of system, the tape deck is removed from the student booth in the conventional laboratory and is replaced by a telephone-type dial and earphones. The reproducing system involves a special-purpose digital computer, crossbar switches similar to those in the telephone system, and a program room containing tape transports, timers and program amplifiers for each player-recorder. The student dials the number of the tape he wants to hear and is connected immediately to the transport containing that tape. The dial units and earphones, like a regular telephone, can be installed in student living quarters, making it unnecessary for the student to go to the laboratory to access audio tapes.

4. Computer Assisted Instruction

Although computers are now quite common in some areas of college and university activity, it is difficult to find cases where the computer is used as an adjunct to instruction. Computers are used rather conventionally to "drive" random-access listening laboratory facilities, to handle student response systems in multimedia classrooms and to assist in the conduct of examinations and assessment of student performance. In a few instances, the student, using teletypewriter terminals and electronic display screens, can access the computer in some types of programmed instruction. A newer technique involves the use of the computer as a device for the selective dissemination of information (SDI). Using an SDI system, the student can store in the computer a profile describing the subjects and information that are of continuing interest to him; as information citations are entered into the system, the computer compares the profile with the input and gives the student a printout of those references which match his fields of interest. Such a system reduces wasteful distribution of information and attempts to narrow distribution to that which exactly matches the student's needs.

5. Special Multimedia Facilities

The several types of multimedia facilities that have been developed in institutions of higher learning represent efforts to solve certain common problems associated with the instructional uses of new media. The facilities include the generously equipped single classroom, the auditorium designed to accommodate large group presentations backed with appropriate audiovisual elements, and the increasingly popular classroom building containing several multimedia classrooms that are served by central new medical facilities. Typically, the multimedia installation will combine a hexagonal or octagonal building a series of triangular rooms of comparatively large capacity surrounding a projection core in which equipment is provided for projection of films, slides, video tapes, and off-the-air or closed circuit television onto a transparent screen at the front of each room. The whole "show" can be controlled by the instructor or by a technician in the core area; there are some systems which allow the entire show to be programmed on punched tape which the instructor can control by a single switch. Some of these facilities are equipped with buttons on each seat which enable the student to answer multiple choice questions; the results can be tabulated and displayed immediately to show whether the majority of the class got the point.

6. Telephone Applications

Lectures by telephone or "telelecture" can be used to take advantage of the instructional contributions of guests who cannot come to the campus but are willing to devote some time to a telephone dialogue with a remotely located class. This technique is used extensively in the medical field for both formal and continuing medical education.

7. Computer Assisted Group Communications

Some encouraging early experiments are being conducted using the computer to assist group communications. The format of these experiments is quite simple. The group meets in a room which has been equipped with several television monitors connected to a computer; each participant is provided a keyboard and a panel to access the computer and control the display of information on the monitors. Prior to the meeting, each participant loads into the computer an outline of his presentation, any graphic materials he intends to use, and whatever special data files pertain to the discussions. During the discussion, each speaker retrieves from the computer whatever data are appropriate and displays them on the TV monitor. Each listener has the option of displaying on his monitor whatever he wants while someone else is talking. For example, he can cycle back to a speaker's earlier display to recheck a point without interrupting the speaker. Those who have experimented with this form of communications believe it is a "significant aid in exploring the depth and breadth of the material." It permits more detailed information to be displayed when facts need to be pinpointed and allows more global information to be displayed to answer questions of relevance and interrelationship.

D. PARTIAL LIST OF ORGANIZATIONS MAKING USE OF AUDIOVISUAL TECHNIQUES

Organization[1]	Type of Activity
Environmental Control Administration HEW Cincinnati, Ohio	Use of TV to communicate the latest techniques and developments to industry, state, and other employers.
Federal Water Pollution Control Administration Cincinnati, Ohio	Use of taped TV to present latest techniques and developments in water pollution.
John F. Kennedy Space Center NASA Kennedy Space Center, Fla. and University of Florida Gainesville, Fla.	State-wide TV network for graduate education--multi-organization cooperation.
Chief of Television Engineering Clinical Center National Institutes of Health Bethesda, Md.	Use of closed circuit TV for demonstrating new medical and surgical techniques.
National Library of Medicine Bethesda, Md.	Source of information concerning most of the audiovisual techniques described in this chapter.
Aeronautical Systems Division Wright-Patterson Air Force Base Dayton, Ohio	Televised closed circuit courses originating from Ohio State campus.

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[1] See Appendix A for the mailing addresses and telephone numbers of the organizations listed.

APPENDIX A

ADDRESSES AND PHONE NUMBERS OF OFFICIALS TO CONTACT FOR ADDITIONAL INFORMATION

MAILING ADDRESS	CONTACT AND/OR PHONE NUMBER
AGRICULTURAL RESEARCH SERVICE (Agriculture)	
Agricultural Research Service U.S. Department of Agriculture Washington, D.C. 20250	Office of the Administrator (202) 388-3656
Northern Utilization Research and Development Division Agricultural Research Service 1815 N. University Street Peoria, Ill. 61606	Director (309) 685-4251
Southern Utilization Research and Development Division Agricultural Research Service 1100 R. E. Lee Blvd. New Orleans, La. 70119	Director (504) 527-7511
Western Utilization Research and Development Division Agricultural Research Service 800 Buchanan Street Albany, Calif. 94710	Director (415) 525-2244
AIR FORCE (Defense)	
Aeronautical Systems Division Wright-Patterson Air Force Base Dayton, Ohio 45433	Chief Scientist (513) 257-55552
School of Aviation Medicine Brooks Air Force Base San Antonio, Texas 78235	Education and Training Division (512) 536-2857
ARMY (Defense)	
Army Ballistic Research Laboratories Aberdeen Proving Ground, Md. 21005	Training Officer (301) 278-4149
Army Missile Command Redstone Arsenal, Ala. 35809	Training Officer (205) 876-5050

MAILING ADDRESS	CONTACT AND/OR PHONE NUMBER
ARMY (Defense) Cont'd	
Human Engineering Laboratory Aberdeen Proving Ground, Md. 21005	Training Officer (301) 278-4149
Natick Laboratories U.S. Army Natick, Mass. 01760	Training Officer (617) 653-1000 x 2457
ATOMIC ENERGY COMMISSION	
Atomic Energy Commission Washington, D.C. 20545	Director, Division of Nuclear Education and Training (301) 973-7758
Ames Laboratory Iowa State University Ames, Iowa 50010	Director's Office (515) 294-2770
Argonne National Laboratory 9700 S. Cass Ave. Argonne, Ill. 60439	Center for Educational Affairs (312) 739-4555
Atomic Energy Project University of Rochester Rochester, N.Y. 14627	Associate Director for Education (716) 275-3905
Associated Universities Incorporated Brookhaven National Laboratories Upton, L.I., N.Y. 11973	Assistant Director for Scientific Personnel (516) 924-7741
Lawrence Radiation Laboratory Livermore, Calif. 94550	Associate Director for Plowshare (415) 447-8301
Oak Ridge Associated Universities P.O. Box 117 Oak Ridge, Tenn. 37830	Special Projects Office (615) 483-4642
	Training and Technology Project (615) 483-4642
Oak Ridge National Laboratory P.O. Box X Oak Ridge, Tenn. 37832	Director, Education and University Relations (615) 483-6251
Oak Ridge National Laboratory P.O. Box Y Oak Ridge, Tenn. 37380	Director, Graduate School of Biomedical Sciences (615) 483-7316

MAILING ADDRESS	CONTACT AND/OR PHONE NUMBER
CIVIL SERVICE COMMISSION	
Washington, D.C., Area:	
Bureau of Training U.S. Civil Service Commission Washington, D.C. 20016	Office of Agency Consultation and Guidance (202) 632-5653
U.S. Civil Service Commission Washington, D.C. 20415	Director, Youth and Economic Opportunity Programs (202) 632-5678
Regional Training Centers U.S. Civil Service Commission	
Atlanta Merchandise Mart 240 Peachtree Street, N.W. Atlanta, Ga. 30303	(404) 526-4477
Post Office and Courthouse Bldg. Boston, Mass. 02109	(617) 223-2569
Main Post Office Building Chicago, Ill. 60607	(312) 353-3914
1114 Commerce Street Dallas, Tex. 75202	(214) 749-3915
Building 20 Denver Federal Center Denver, Colo. 80225	(303) 233-2304
Federal Building 26 Federal Plaza New York, N.Y. 10017	(212) 264-0460
Customhouse Second and Chestnut Streets Philadelphia, Pa. 19106	(215) 597-4442
Federal Building, Box 36010 450 Golden Gate Avenue San Francisco, Calif. 94102	(415) 556-5738
3004 Federal Office Building Seattle, Wash. 98104	(206) 583-4700
Federal Building 1520 Market Street St. Louis, Mo. 63103	(314) 622-4274

MAILING ADDRESS	CONTACT AND/OR PHONE NUMBER
COMMERCIAL FISHERIES (Interior)	
Tropical Atlantic Biological Laboratory Bureau of Commercial Fisheries 75 Virginia Beach Drive Miami, Florida 33149	Director (305) 361-5761
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION (Interior)	
Taft Sanitary Engineering Center 4676 Columbia Parkway Cincinnati, Ohio 45226	Director, Cincinnati Water Research Laboratory (513) 871-6225
FOREST SERVICE (Agriculture)	
Forest Products Laboratory U.S. Department of Agriculture N. Walnut Street Madison, Wis. 53707	Director (608) 257-2211
Pacific Southwest Forest and Range Experiment Station 1960 Addison Street P.O. Box 245 Berkeley, Calif. 94701	Director (415) 841-5121
FOUNDATIONS	
Foundation for Advanced Education in the Sciences c/o NIH, Bethesda, Md. 20014	President (301) 496-6007
GEOLOGICAL SURVEY (Interior)	
U.S. Geological Survey Washington, D.C. 20242	Office of the Director (202) 343-3437 Office of the Chief Geologist (202) 343-2588 Assistant Chief Geologist (202) 343-4176
U.S. Geological Survey 601 East Cedar Avenue Flagstaff, Arizona 86001	Chief, Branch of Astrogeologic Studies (602) 774-1455
U.S. Geological Survey 345 Middlefield Road Menlo Park, Calif. 94025	Pacific Coast Region Committee (415) 325-2211

MAILING ADDRESS	CONTACT AND/OR PHONE NUMBER
GEOLOGICAL SURVEY (Interior) Cont'd	
U.S. Geological Survey Denver Federal Center Denver, Colo. 80225	Rocky Mountain Region Committee (303) 233-8602
HEALTH, EDUCATION AND WELFARE	
Environmental Control Administration 222 East Central Parkway Cincinnati, Ohio 45202	Director, Training Institute (513) 684-2332
National Communicable Disease Center Atlanta, Ga. 20322	Training Officer (404) 633-3311
National Institutes of Health Bethesda, Md. 20014	Deputy Director for Science (301) 496-2435
	Chief, Personnel Staffing Branch (301) 496-2237
	Chief of Television Engineering Clinical Center (301) 496-5941
National Library of Medicine Bethesda, Md. 20014	Director, Lister Hill National Center for Biomedical Communication (301) 496-4441
INDUSTRY	
Bell Telephone Laboratories Murray Hill, N.J. 07974	Director of Research, Physics and University Relations (201) 582-2672
NATIONAL AERONAUTICS & SPACE ADMINISTRATION	
Ames Research Center NASA Moffett Field, Calif. 94035	Director (415) 961-1111
	Public Affairs Office (415) 961-1111
Electronic Research Center NASA 575 Technology Square Cambridge, Mass. 02139	Training Director (617) 491-1501
	Personnel Director (617) 491-1501

MAILING ADDRESS	CONTACT AND/OR PHONE NUMBER
NATIONAL AERONAUTICS & SPACE ADMINISTRATION Cont'd	
Flight Research Center NASA P.O. Box 273 Edwards, Calif. 93523	Training Director (805) 258-3311
George C. Marshall Space Flight Center NASA Huntsville, Ala. 35812	Training Director (205) 877-1000
Goddard Institute for Space Studies NASA 2880 Broadway New York, N.Y. 10025	Director (212) 866-3600
Goddard Space Flight Center NASA Greenbelt, Md. 20771	Training Director (301) 474-9000
John F. Kennedy Space Center Kennedy Space Center, Fla. 32899	Training & Employee Development Branch (305) 867-2737
Langley Research Center NASA Langley Station Hampton, Va. 23365	Associate Director (703) 827-1110 Training Director (703) 722-7961
Lewis Research Center NASA 21000 Brookpark Road Cleveland, Ohio 44135	Training Director (216) 433-4000 Public Affairs Office (216) 433-4000
Manned Spacecraft Center NASA Houston, Texas 77058	Personnel Director (713) 483-0123
Office of Public Affairs NASA Washington, D.C. 20546	Teacher Services & Spacemobile Program (202) 962-2562
Wallops Station NASA Wallops Island, Va. 23337	Director (703) 824-3411 Training Officer (703) 824-3411

MAILING ADDRESS	CONTACT AND/OR PHONE NUMBER
NATIONAL AERONAUTICS & SPACE ADMINISTRATION Cont'd	
Office of University Affairs NASA Washington, D.C. 20546	Asst. Administrator for University Affairs (202) 962-8107
	Director, Sustaining University Program (202) 962-3119
NATIONAL BUREAU OF STANDARDS (Commerce)	
National Bureau of Standards Washington, D.C. 20234	Associate Director for Academic Liaison (301) 921-2461
	Educational Office (301) 921-3497
	Training Officer (301) 921-3421
Joint Institute for Laboratory Astrophysics University of Colorado Boulder, Colo. 80302	Chief, Laboratory Astrophysics Division (303) 447-1000
NATIONAL RESEARCH COUNCIL	
National Research Council 2101 Constitution Ave., N.W. Washington, D.C. 20418	Office of Scientific Personnel (202) 393-8100
NATIONAL SCIENCE FOUNDATION	
Kitt Peak National Observatory 950 N. Cherry Avenue Tucson, Ariz. 85717	Director (602) 327-5511
National Center for Atmospheric Research Boulder, Colo. 80302	Director (303) 444-5151
National Radio Astronomy Observatory Edgemont Road Charlottsville, Va. 22901	Director (703) 296-0211

MAILING ADDRESS	CONTACT AND/OR PHONE NUMBER
NAVY (Defense)	
Naval Ordnance Laboratory White Oak, Md. 20910	Employee Development Division (301) 495-7411
Naval Research Laboratory 4555 Overlook Ave., S.W. Washington, D.C. 20390	Director of Research (202) 767-3301
Annapolis Division Naval Ship Research & Development Center Annapolis, Md. 21402	Technical Director (301) 268-7711 x 8216 Training Branch (301) 268-7711 x 8210
Naval Weapons Center China Lake, Calif. 93555	Employee Development Center (714) 375-1411
Navy Air Engineering Center Philadelphia, Pa. 19107	Personnel Department (215) 755-3724
SMITHSONIAN INSTITUTION	
Smithsonian Institution Washington, D.C. 20560	Director, Office of Academic Programs (202) 381-5209
UNIVERSITIES AND COLLEGES	
American University Massachusetts & Nebraska Aves., N.W. Washington, D.C. 20016	Chairman, Chemistry Department (202) 244-6800 x 265
George Washington University 725 23rd Street, N.W. Washington, D.C. 20006	Dean of Engineering (202) 676-6080
Stanford University Stanford, Calif. 94305	Department of Civil Engineering (415) 321-2300
University of Alabama Huntsville, Ala. 35807	Director, Research Institute (205) 895-6120
University of Florida Gainesville, Fla. 32601	Director, External Engineering Programs (904) 376-3261
Wright State University Colonel Glenn Highway Dayton, Ohio 45431	President (513) 426-6650

APPENDIX B

LABORATORY MEETING CALENDARS

U. S. DEPARTMENT OF COMMERCE · NATIONAL BUREAU OF STANDARDS

National Bureau of Standards Technical Calendar

(Covering Activities in the Washington Area)

The National Bureau of Standards Technical Calendar is issued regularly on Thursday listing activities of interest primarily to the Washington staff. Notices to be included in the regular issue should be transmitted in writing and should be transmitted in time to be received by **noon on Wednesday**. Requests for this calendar and notices should be sent to Room A617, Administration Building, attention Mrs. Betty Arnold Oberholtzer, Editor, phone: 921-2264. (Code 164) Extension 2264.

All lectures and meetings are open to staff members and their associates except when otherwise stated, i.e., closed, invitation, society, etc.

August 18 to August 22, 1969

MEETING AT THE NATIONAL BUREAU OF STANDARDS
Gaithersburg, Maryland

August 22, Friday 11:00 A. M.	BUILDING RESEARCH DIVISION MEETING: Full-Scale Investigation of Wind Effects on Structures, S. L. Mackey, University of Hong Kong, Hong Kong. Green Auditorium, Administration Building.

MEETINGS ELSEWHERE OF INTEREST TO NBS PERSONNEL

August 18, Monday 3:00 P. M.	NAVAL RESEARCH LABORATORY JOINT METALLURGY DIVISION AND SOLID STATE DIVISION COLLOQUIUM: The Inelastic Scattering of Light from Metals, D. L. Mills. University of California, Irvine, California. Building 60, 4th Floor Conference Room (Room 401), Naval Research Laboratory, Washington, D. C. (U. S. Citizens, see the receptionist at the visitors entrance for a pass before entering NRL. Non-Citizens, call Mrs. Mary Downer, 767-2600 or 197-2600.)
August 19, Tuesday 3:00 P. M.	NAVAL RESEARCH LABORATORY NUCLEAR PHYSICS DIVISION SEMINAR: Half-Life Measurements and Their Significance to Various Models, G. Lobner, Technical High School at Munich. Conference Room (Room 117), Building 75, Naval Research Laboratory, Washington, D. C.

TALKS BY NBS WASHINGTON PERSONNEL

FREEMAN, D. H.: "Characterization of Ion Exchange Networks: Theory, Microscopy and Spectroscopy", Gordon Conference on Ion Exchange, Kimball Union Academy, Meridan, New Hampshire, Aug. 18, 1969.

KELLER, R. A.: "Organic Dye Lasers", National Institutes of Health, NIAMD, Bethesda, Md., Aug. 5, 1969.

NEWMAN, M.: "Number Theoretic Subroutines for High Speed Digital Computers and Number Theory" and "Computational Problems Connected with Certain Matrix Groups", Atlas Symposium Number 2 on Computers and Number Theory, Oxford, England, Aug. 20-21, 1969.

ROCKETT, J. A.: Panel Discussion on the relation of the Fire Research and Safety Act to fire fighting and communications in the fire services, International Municipal Signal Association, Boston, Mass., Aug. 19, 1969.

VADELUND, E. A.: "Status of Federal and State Packaging and Labeling Regulations", Gift Wrappings and Tyings Association, The Seigniory Club, Montebello, Quebec, Canada, July 30-Aug. 1, and "A Review of the Fair Packaging and Labeling Act", Minnesota Chapter of Society of Packaging and Handling Engineers, Minneapolis, Minn., Sept. 3, 1969.

The following talks will be presented before the Eighth International Congress of Crystallography, State University at Stony Brook, Stony Brook, N. Y., Aug. 19-22, 1969

GRAVATT, C. C.: "Slit Correction Effects in the Bonse-Hart Small Angle Diffractometer" and "Investigation of Phase Transitions in Liquid Crystal Systems by Small Angle X-Ray Scattering".

RENEKER, D. H.: "The Role of Crystallography in Polymer Physics".

STEPHENSON, N. C.: "Systematics of Non-Stoichiometry in the Ta_2O_5-WO_3-Al_2O_3 System".

The following talks will be presented before the Section on Physical and Engineering Sciences, American Statistical Association, Joint Statistical Meeting, New York, N. Y., Aug. 19-22, 1969

HOGBEN, D.: "Computing for the Countless".

MANDEL, J.: "Non-linear Approximation to Tabulated Functions for Electronic Computers".

TALKS BY NBS BOULDER PERSONNEL

The following talks will be presented before the XVIth General Assembly of the International Union of Radio Science (URSI), Ottawa, Ontario, Canada, Aug. 18-21, 1969

ARTHUR, M. G.: "Standardization and Precision Measurement of Thermal Noise in the USA.

BARNES, J. A.: "Improvements in Cesium Beam Frequency Standards at the National Bureau of Standards".

NAHMAN, N. S.: "Determination of the Dielectric Relaxation Time in a Debye Binary Liquid by Pulse Measurements".

FOREIGN VISITORS TO THE NATIONAL BUREAU OF STANDARDS

Week of August 18 - 22

August		
18	Professor F. Berg Rasmussen Universitetets Fysiske Laboratorium I H. C. Orsted Institutet Universitetsparken 5 Copenhagen Denmark	Dr. Chester Page, 211.00
18 - 21	Dr. N. G. Rambidi Institute for High Temperatures Krasnokazarmennaya 17a Moscow E-250, U.S.S.R.	Donald D. Wagman, 316.11
19	Dr. D. Isabelle Ecole Normale Superieure Laboratoire De. L'Accelerateur Lineaire Boite Postale No. 5 Orsay (S & G), France	Dr. J. E. Leiss, 502.00
20 - 22	Mr. Kazue Nishihara Industrial Arts Institute, Japan Presently at: University of S. Calif. Dept. of Civil Engineering Los Angeles, California 90007	J. D. Ramboz, 213.02
22	Dr. V. A. Danilychev Senior Researcher Physics Institute Im. P. N. Lebedev USSR	Dr. Wm. S. Horton, 313.00 Dr. H. P. R. Frederikse, 313.07
22	Dr. Dittmann Physikalisch-Technische Bundesanstalt Institut Berlin Abbestrasse 2-12 1 Berlin 10, West Germany	Dr. L. Marton, 156.00 Dr. L. Grabner, 313.07

For further information call the National Bureau of Standards, Office of International Relations on 921-2463.

NIH CALENDAR OF EVENTS

(Covering Activities in the Washington Area)

The National Institutes of Health Calendar of Events is issued every Thursday. It lists lectures, seminars, meetings, etc. of the NIH staff and of scientific and medical organizations in the Washington Area. Notices must be transmitted in writing and received by 10:00 a.m. on Wednesday, (Bg. 31, Rm. 2B-03) attention: Virginia Backora, Editor. For information on the distribution of the Calendar, call extension 6-2266. Tube DS-4

June 23 - 29, 1969

Mon., June 23

1:00 p.m. NCI Seminar. Prospects for high voltage electron microscopy in biology. Speaker: Dr. V. E. Cosslett, Cavendish Labs., Cambridge, England. Bg. 1, Wilson Hall.

3:30 p.m. - 4:30 p.m. NICHD Gerontology Research Center Seminar. Lysosomes, involution and aging. Speaker: Dr. D. Brandes, Dept. of Pathology, Baltimore City Hosp. Conf. Rm. 1-117, Gerontology Research Center, Baltimore City Hospitals, Baltimore.

Tues., June 24

10:30 a.m. NINDS Seminar. Biosynthesis of frog visual pigment. Speaker: Michael O. Hall, Ph. D., Jules Stein Eye Institute, Calif. Bg. 10, Rm. 9N-230.

12:00 noon Human Tumor Cell Biology Branch Seminar. The enzymatic alkylation of transfer RNA and its biological significance. Speaker: Dr. Ronald L. Hancock, Ph. D., The Jackson Lab., Bar Harbor, Me. Bg. 10, Rm. 2B-56.

1:30 p.m. NCI Dermatology Branch Seminar. Correlative lipid biochemical and electron microscopic findings on human xanthomas. Speaker: Dr. Frank Parker, Div. of Dermatology, Univ. of Washington. Bg. 10, Rm. 2B-56.

3:00 p.m. NIGMS Seminar. The invisible university: postdoctoral education in the United States. Speaker: Dr. Richard Curtis, Assoc. Dean, Off. of Research and Advanced Studies, Indiana Univ. Westwood Bg., Conf. Rm. C.

3:00 p.m. NIMH-LCS Seminar. Pharmacological and physiological regulation of central monoaminergic neurons. Speaker: Dr. Jacques Glowinski, Laboratory de Neurophysiologie Generale College de France, Paris. Bg. 10, Rm. 4N-226.

Wed., June 25

11:00 a.m. NCI-Endocrinology Branch Lecture. Estradiol measurement of human plasma. Speaker: Stanley G. Korenman, UCLA School of Medicine and Los Angeles County General Hosp. Bg. 10, Rm. 2B-56.

3:00 p.m. NIDR Seminar. Barnacle and other bioadhesives and their potential in medicine and dentistry. Speaker: Dr. Michael Cook, Lecturer in Operative Dental Surgery, Sutherland Dental School, The Univ. of Newcastle upon Tyne, England. Bg. 30, Rm. 117.

3:30 p.m. NIMH-SMR-N Seminar. Monoamines in the developing brain and their modulation by hormones. Speaker: Dr. C. M. Hardin, Dept. of Physiology, George Washington Univ. William A. White Bg. Aud., Saint Elizabeths Hosp. Further info: Dr. Bloom, Code 1620, ext. 474.

Thurs., June 26

1:15 p.m. NIAMD-LMB Seminar. Present state of the carbonic anhydrase structure investigations. Speaker: Dr. K. K. Kannan, Wallenberg Lab., Univ. of Uppsala, Sweden. Bg. 10, Rm. 9N-230.

Fri., June 27

9:00 a.m. Next NIAMD Clinical Conference will be held July 11th.

11:00 a.m. NCI Grand Rounds. Annual presentation of research projects by clinical associates (eighth in a series of eight presentations). The nature of immunoglobulin responses in rabbits. Speaker: Dr. John Clough. Immunoglobulin gene expression in human lymphoid cells. Speaker: Dr. Donald Buell. Clinical Center Aud.

11:15 a.m. - 12:45 p.m. NIMH-APB Seminar. Implications of the phenomenon of parentification. Speaker: Ivan Boszormenyi-Nagy, M.D., Dir., Family Therapy Project, Eastern Pennsylvania Psychiatric Inst., Philadelphia. Bg. 10, Rm. 4N-226.

12:00 noon NIMH Seminar. Morphology and function of tight junctions in the central nervous system. Speaker: Dr. Thomas S. Reese, NINDS-LNS. Bg. 36, Rm. 2D-10.

Reporters

NCI, Mrs. Reed, ext. 65737; NHI, Mrs. Bradley, ext. 62157; NIAID, Mrs. Holmes, ext. 65717; NIAMD, Mrs. Larson, ext. 65765; NICHD, Miss Ayers, ext. 65133; NIDR, Mrs. Whitehurst, ext. 61483; NIEHS, Miss Dunn, ext. 64903; NIGMS, Mrs. Warddell, ext. 67245; NIMH, Miss Funkhouser, ext. 60473; NINDS, Mrs. Messite, ext. 65751; NLM, Mr. Gilkeson, ext. 63661; CC, Mrs. Burdette, ext. 62563; DBS, Mrs. Peterson, ext. 63343; DCRT, Mrs. Crowe, ext. 65703; DRG, Mrs. Pence, ext. 67441: DRR, Mrs. D[illegible]ng, ext. 65545; DRS, Mrs. Ettelstein, ext. 64133

OTHER MEETINGS

Mon., June 23

4:00 p.m. Research Foundation of the Washington Hospital Center Seminar. Problems in the evaluation of known drugs. Speaker: Dr. R. Keith Cannan, Nat. Res. Council, Nat. Acad. Sci. Library, George Hyman Memorial Research Bg., 110 Irving St., N.W.

4:00 p.m. Sinai Hospital of Baltimore, Inc., Seminar in Biochemical Pharmacology. Recent investigations on brain steroids. Speaker: Rodolfo Paoletti, M.D., Prof. of Pharmacology, Univ. of Milan. Zamoiski Aud., Sinai Hosp. of Baltimore, Inc., Belvedere and Greenspring Aves.

Tues., June 24

3:30 p.m. American Institutes for Research Seminar. Psychiatric rating scales and clinical drug evaluation. Speaker: Dr. Frantisek Engelsmann, Psychiatric Res. Inst., Prague, Czechoslovakia. AIR Library, 5th Fl., 8555 16th St., Silver Spring.

APPENDIX C

HIGHER EDUCATION PROCEDURES AND PROGRAMS AT THE SMITHSONIAN INSTITUTION

1. One point of difficulty in the development of higher education programs lies in informing universities about them. The Smithsonian Institution publishes an annual booklet entitled Smithsonian Institution Opportunities for Research and Advanced Study. This publication describes the programs through which the Smithsonian may provide support to students and other investigators who desire training or the opportunity to further their academic objectives. It also describes all major research activities and presents biographical listings of members of the professional research staff in nine broad areas of research activity and interest within the Institution. For the academic year 1969-1970 these program areas have been identified as follows: American Studies, Anthropology, Evolutionary and Systematic Biology, Environmental Biology, Evolutionary and Behavioral Biology (Tropical Zones), Physical Sciences, History of Science and Technology, Cultural Studies, and Museum Studies. Each section of the publication contains an introductory statement concerning the broad objectives of the individual program plus a brief description of the research activities and objectives within the departments of the Institution considered within that area. A new edition of the booklet is made available each fall and is distributed to all major colleges and universities in the United States; copies being sent to deans' offices and university libraries. In addition, separate sections on each program are sent to departmental offices.

2. Another point of difficulty in accommodating students in the laboratory lies in properly identifying the relationships between each student's program and the interests of laboratory staff members. A graduate-school transcript and a recitation of past employment communicate very little that is meaningful from the perspective of the laboratory's distinctive approach to its problems. Consequently the Smithsonian asks each applicant for educational appointment to present a short statement in essay form, covering the following points: first, to characterize his prior education and state his primary academic goals; second, to describe a project that he wishes to conduct within the laboratory and indicate the contribution he believes that the laboratory or its staff may make to meeting those goals; and third, any special equipment or facilities which he may require including publication assistance, travel, advanced courses, etc. This essay is evaluated in writing by staff members, and selection committees are guided by their comments. No appointment may be accepted by a student until his university has formally approved.

3. The host unit of each student appointed is provided with a supplementary allowance for xeroxing, library fees, travel to meetings, and minor supplies so that these do not become a charge against the host unit. The students' supervisors approve expenditures. The basic mechanism of support is by a fellowship award to the student, of which ten percent may be advanced or paid on arrival.

4. The students are grouped into program categories by academic discipline rather than by main lines of internal Smithsonian organization. One purpose in so doing is to delineate the groups most likely to participate in, and benefit from, seminars and other instructional activities, which may then be afforded to nearby universities.

5. The steering committees composed of staff members each year submit estimates of the level of educational activity by major type desired by themselves and their colleagues. Education programs are then designed in response to such expressions of interest.

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[1] Substantial assistance in compilation of this report was also received from:

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